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EXPERIMENTAL OPERATIONS ON THE ORIFICES OF THE HEART*

BY ALEXIS CARREL, M D

OF NEW YORK

(From the Laboratories of the Rockefeller Institute for Medical Research, New York)

IN the course of experiments made in 1913 and 1914 an attempt was made to develop technics by means of which plastic operations on the pulmonary and the aortic orifices of the heart could be performed. As it is the object of these operations that they be ultimately applied to human surgery, it was primarily necessary to accumulate about the operative procedure a number of factors of safety. It is not sufficient that a plastic operation be possible in order to be practicable. It must also be not dangerous. An attempt was therefore made, not only to perform plastic operations on the orifices of the heart, but to perform these operations without danger to the animal.

The animals were etherized according to the Meltzer-Auer method, and the thoracic cavity was opened under precautions precluding the occurrence of pleurisy. When the operative field had been walled off with silk and cotton knotted compresses, the pericardium was opened and the heart exposed. Then, according to the operation to be performed, the circulation of the heart was arrested and the pulmonary or aortic orifices were exposed and opened. In order to ensure the safety of this stage of the operation a number of details of technic had to be observed.

I The arresting of the circulation of the heart has already been performed in many different ways by various experimenters. We ourselves have used all known methods of stopping the circulation through the heart. Finally we adopted the method of the clamping in mass of the pedicle of the heart by means of a large soft-jawed forceps. The heart was not taken out of the pericardium but the incision of the pericardium was large enough to permit of the easy introduction of

* Read before the American Surgical Association, April 10, 1914

longer than the other. This permitted of the perforation of the wall of the artery or heart before cutting. The location of the incision was exactly determined. For the pulmonary artery the incision was made on the left side of the artery at a point corresponding with the junction of the anterior and left sigmoid valves. Several times the valves were exposed by an incision made only on the pulmonary artery. Generally they were exposed by an incision of about 4 cm. made half on the pulmonary artery and half on the ventricle of the heart. In that region the branches of the coronary artery are small and can be cut without danger. The exposure of the aortic valves was made through an incision located on the right side of the aorta between the mouth of the right and the left coronary arteries, generally directly above the middle of the right valve. Great care was taken not to injure the mouth or the branches of the coronary arteries.

3 The opening of the ventricles or of the pulmonary artery and the aorta is always followed by entrance of air into the heart. When the pulmonary artery and the right ventricle were opened, no special care was taken to empty the heart of air at the conclusion of the operation. The quantity of air was probably very small. No accidents have been observed after the entrance of air into the right heart and the lungs. But the introduction of air into the aorta and the left ventricle was very dangerous. When the operation was completed and the circulation re-established the air emboli were sent through the coronary vessels, and this caused fibrillary contractions of the heart and consequent death. On several occasions it was possible to see the air emboli in the coronary arteries. It was, therefore, necessary for the safety of the operation to eliminate the possibility of such a complication. This could be done by aspirating the air contained in the heart by means of a large needle or cannula introduced into the ventricle or into the aorta and connected with a vacuum apparatus. This operation was performed rapidly just before the removal of the clamp and the re-establishment of the circulation.

Several kinds of operations were performed. The sigmoid valves of the aorta were exposed and cauterized. The pulmonary orifice was cut after the wall had been patched with a piece of vessel preserved in cold storage. These three operations were performed with the purpose of ascertaining whether operations such as should be made in cases of inflammation, stenosis, or dilatation of the orifices would be possible.

1 *Opening of the Aorta and Cauterization of the Sigmoid Valves*—After the artery was exposed and the pedicle clamped the aorta was opened by an incision made with the scissors, just

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too narrow and did not allow for the dilatation of the orifice. The result was that no murmur could be heard by auscultation. Nevertheless, in two cases a marked diastolic murmur was present a few weeks after the operation. It was found that in these dogs the murmur had disappeared after five months. It must be noted also that these remote results demonstrated that a piece of vein put on the pulmonary artery in contact on the one side with dark blood, on the other with the pericardium that is in an unfavorable condition of nutrition, did not undergo necrosis.

The results of the suture of the sigmoid valves were better. Three operations were performed. Although there was an interruption of the circulation of the heart by the clamping of the pedicle, and the heart and artery were widely opened, the condition of the animals remained perfect, both during the operation and afterwards. Not only did these three animals sustain no shock, but their condition at the end of the operation was exactly the same as after the mildest kind of operation. In the afternoon of the day of the operation they were entirely normal again, and to-day, that is 25 days after the operation, they are in excellent condition. The dog on which the section and the suture of the sigmoid valve was performed is an animal about eight years old. Nevertheless his general condition was not modified by the operation.

The purpose of these operations was to show how extensive a plastic operation on the heart can be made without danger to the life of the animal. The results demonstrate that many factors of safety have been placed in the technique. It will perhaps be possible to perform much more complicated operations than those we have described. The results are being published at the present time merely to show that plastic operations on the heart need not be dangerous. It is not impossible that some day surgeons will be able to cauterize valvular lesions or to remove them as we do to-day in our experimental operations.

ON BRONCHIECTASIS*

BY WILLY MEYER, M D

OF NEW YORK

ATTENDING SURGEON TO THE GERMAN AND POST-GRADUATE HOSPITALS

BRONCHIECTASIS is a disease of the bronchial tree, *not* of the pulmonary parenchyma. Formerly belonging entirely to the domain of internal medicine, it has, within the last decade, together with many other affections, entered the borderland and is at present a subject of general inquiry. Particularly among surgeons has its treatment created wide-spread interest. Laryngology, too, has added its possibilities to the various other means at our disposal in the fight against this hydra-headed and torturing disease, and medical technic has given us a device which lends further assistance. With the multiplication of the points of attack, we can say that the near future seems to hold out greater hopes for a complete recovery to the unfortunate individuals afflicted with this chronic ailment, a disease, in which, so far, the combined efforts of all the medical specialties concerned have been able to achieve improvement only, but no cure.

The literature on the subject shows that the surgical treatment of bronchiectasis dates back to 1873, when Mosler proposed the incising and draining of a bronchiectatic cavity. Later, Lenhartz, Quincke, Garrè, Korte, Tuffier, Brauer and others devoted much thought to the disease and furthered its treatment in original ways. The pathologists, too, have added their share, of late, particularly Aschoff (still unpublished). In 1911, Sauerbruch read an article before the International Surgical Congress at Brussels, the most comprehensive review of the subject so far published, in the course of this paper it has been repeatedly quoted.

In the English language, to my knowledge, there exists no exhaustive treatise on bronchiectasis. It appeared worth while, therefore, to review what is known about the disease and its therapy in all its phases,—pathological, medical and surgical. Only the absolutely essential will be mentioned. For the sake of conciseness, names of authors have been omitted as much as possible.

Pathological Anatomy—Bronchiectasis, distention of the bronchi, is either diffuse (cylindrical) or circumscribed (sacculated, spindle-shaped—rare—or of varicose appearance).

* Read before the American Surgical Association, April, 1914

ALEXIS CARREL

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Pathological Anatomy—Bronchiectasis, distention of the bronchi, is either diffuse (cylindrical) or circumscribed (sacculated, spindle-shaped—rare—or of varicose appearance).

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The diffuse variety is of pathological interest only and often shows the disease but slightly developed. It is recognized by the fact that at autopsy the bronchi can be divided with scissors almost to the pleural covering of the lung, particularly in the lower lobes.

Circumscribed bronchiectasis is found singly or multiple. It is the usual type met with clinically. Not infrequently the cavities are so numerous that a cross-section of the lung in places resembles a honey-comb.

The size of the cavities in the adult varies from that of a bean to that of a hen's egg. In very small children they have been found as large as a pea.

The afferent bronchus usually enters the distended portion quite abruptly, rarely in a gradual way, not infrequently it is strictured just in front of it.

The cavities contain a mucopurulent, often fetid secretion. If the latter becomes very thick, lime salts may be deposited in it, so that incrustations the size of a cherry pit and larger, so-called broncholiths, are formed.

The mucous lining of the bronchiectatic cavities is invariably in an inflammatory condition, sometimes the walls are hypertrophied and villous. This hypertrophy may involve all the layers of the wall, mucous glands, muscle and elastic fibres, cartilage and peribronchial tissue, while in other places the wall may appear smooth or irregularly striped, its just enumerated normal elements having more or less disappeared and connective tissue taking their place. The epithelial lining is missing, as a result of atrophy and cicatrization. Thus atrophic and hypertrophic portions of the bronchial wall may be found in closest proximity. Often lime salts are deposited in the pathologically changed tissues, particularly in the cartilage. The distal end of the diseased bronchus may become obliterated, adjoining cavities may become confluent owing to atrophy of the dividing walls.

The disease is sometimes found in the middle lobe of the right lung but most frequently in the lower lobes of either side. Tuffier saw it in the latter in forty out of forty-five cases. Both lungs may be affected at the same time. Men are, by far, oftener afflicted than women. A predisposition as to a certain time in life for the development of the disease does not exist.

Etiology—Bronchiectasis may be congenital as well as acquired.

If congenital, the whole lung, or a portion of it, presents a great many small cysts with very thin walls, filled with a watery or mucoid fluid, a condition which most likely is due to an arrested development.

no alveoli having formed in the affected parts, but only larger bronchi in increased abundance. Another explanation is congenital (fetal) pulmonary atelectasis, the latter preventing the proper development of the growing bronchial tree.

Some of these patients with congenital bronchiectasis are known to have reached old age (65 years).

If acquired, various causes may bring it on. Bronchiectatic distention may develop in the distal portion of the tubes, if the bronchial wall is compressed from within (ecchondrosis) or from without (aortic aneurism). The bronchi then distend to irregular sacculations, containing many cartilaginous rings and mucous glands, the interposed parenchyma of the lung gradually atrophies (atelectatic bronchiectasis).

Another type is represented by compensatory distention of the bronchi, in case of shrinking and thickening processes in lungs and parietal pleuræ, and can be best observed in patients who have been operated upon for empyema following acute pneumonia after the visceral pleura has become thoroughly adherent to the parietal. This explanation of the occurrence of the disease is supported by experiments made by Sauerbruch in conjunction with Bruns, which showed that ligation of branches of the pulmonary artery produces connective-tissue hyperplasia and extensive adhesions between visceral and parietal pleura. After some time marked dilatation of the bronchi was found in these animals, a phenomenon which cannot be explained otherwise than by traction of the shrinking connective tissue in the lobes of a lung which is adherent to the chest wall.

The most frequent cause of bronchiectasis is *chronic* inflammation.

In childhood measles, whooping-cough and influenza represent predisposing causes, the symptoms then increase with advancing age. If the disease develops later, it is usually the consequence of primary inflammation of the bronchial wall itself, whereby its strength is weakened, or it is consecutive to inflammatory processes of pleura or lungs.

Other predisposing causes are harmful effects due to occupation, extravagant use of alcohol and tobacco and irregular habits.

The pathological sequence of the phenomena has not yet been definitely made out. It is possible that increased intrapulmonary pressure, as it occurs in singing, screaming, persistent coughing, may gradually produce permanent distention of a weakened portion of the bronchial wall all the more if some parts of the lung are unduly taxed on account of disease of other parts and the latter's consequent inability to do their share of the work.

However, circumscribed cavities certainly develop oftener, if in

the presence of inflammatory changes the bronchial tube becomes bent or stenosed, so that the mucous secretion is not properly drained off and gets a chance to accumulate. The secretion then becomes mucopurulent or purulent and, through the working of bacteria, decomposed (putrid bronchiectasis). Unhealthy looking ulcers develop, which gradually involve the wall of the bronchi and produce gangrenous inflammation of the neighboring lung tissue. Severe hemorrhages may occur by erosion of blood-vessels, particularly if the latter, too, are found distended, either uniformly or in the shape of small aneurisms. In other places, where the secretions can be better drained off, easily bleeding granulations spring up, which often tinge the expectoration with blood. These granulations gradually destroy the longitudinal bands of the elastic fibres which, not unlike a continuous rubber band, are found distributed throughout the entire bronchial tree. They often also destroy the muscular fibres of the bronchial tubes. According to Aschoff, this destruction of the elastic longitudinal ligaments (Langsbänder) is the principal causative factor in the development of bronchiectatic cavities. The same kind of destruction occurs in the development of aneurisms. With the latter bronchiectasis can be best compared (private communication). The inflammatory process invariably spreads to adjoining healthy portions of the bronchial tree in which ectasies have not yet developed. If the foul secretions are aspirated into such parts of the lung, lobular catarrhal pneumonia develops. In other instances the bronchi may become more and more stenosed, sometimes even obliterated, thus interfering with proper drainage. The formation of a lung abscess is the consequence.

On the other hand secondary affection of the adjacent lung parenchyma, or secondary atelectasis, may also produce fibrous thickening of the lung tissue, with compensatory emphysema. If the foci are near the surface of the lung, pleural adhesions, too, will form, establishing thus a typical vicious circle.

If the bronchiectatic cavity becomes entirely encapsulated, a cyst of the lung may develop, its contents may become thickened through absorption and gradually solid through salt deposits, this represents another mode of broncholith-formation (see above).

In one instance has the aspiration of a foreign body, which remained *in situ* unrecognized for a long period (a few years) been the etiological factor of producing bronchiectasis with voluminous expectoration of a fetid sputum (Knoepfelmacher *Muench med W*, 1912, p 1132).

Symptomatology—In the beginning of the disease the clinical symptoms are often rather insignificant. The paroxysmal cough with

purulent expectoration is usually taken by the patient for a pharyngeal or bronchial catarrh and he hardly ever consults a doctor until the sputum becomes admixed with blood and of foul odor and taste. Coughing spells set in, as a rule, when the patient changes his position, they also occur at irregular intervals during the day in the midst of quiet occupation, or during the night while sleeping. Many patients are able to expectorate at will. The sputum is abundant and fills the mouth of the patient faster than he can get rid of it, the procedure is more like a vomiting spell. The odor of the sputum frequently is exceedingly foul, so much so that the patients become a burden to their families and to themselves. In institutions it may become necessary to isolate them. Not infrequently blood is admixed with the sputum. Serious attacks of hæmoptysis have repeatedly been seen.

The collected sputum presents the well-known three layers. In the lower one, nodular masses (Dietrich's Pfropfe) may be found. Microscopical examination reveals a large amount of pus corpuscles in all stages of disintegration, fat globules, needles of margaric acid and an array of bacteria. Elastic fibres are rarely seen, but whole pieces of gangrenous lung tissue are not infrequently coughed out.

In general, these patients do not feel very sick, few have dyspnoea. However, they make the impression of people who are chronically ill. Children and younger individuals appear undeveloped and anæmic. When the sputum has become putrid, septic fever and night sweats set in. As a rule, the tip of the fingers and toes are club shaped. The entire picture greatly resembles that of pulmonary tuberculosis. Many of these patients are found in sanatoria for consumptives, tubercle bacilli, however, are never demonstrated in the sputum.

Diagnosis—In view of the character of the symptoms above enumerated, it is but natural that many errors in diagnosis occur, and as a result the medical man often witnesses pathetic scenes. Thus one of my own patients, a young married woman of the laboring class, had become separated from her husband, because the district nurse insisted that she had pulmonary tuberculosis. The husband kept the two children and she was sent to a sanatorium for tuberculosis. Having been discharged from the latter, she went to live with her mother. Later, after the definite diagnosis was established, a proper explanation of the true state of affairs to both parties reunited the couple.

The diagnosis certainly is not easy, at least not in the early stages of the disease. Most frequently it is confounded with tuberculosis or purulent bronchitis. Continued careful observation will gradually reveal the true condition.

In the later stages pulmonary abscess or pulmonary gangrene from other causes, fetid bronchitis and empyema with perforation into the bronchial tree, come into consideration as regards differential diagnosis

Our usual methods of physical examination often fail to render reliable assistance. On percussion, a few dull or tympanitic spots may be made out over the lower and middle lobes, usually on one side only, according to the extent and degree of retention of the secretion within the cavities and the patient's posture. If much peripheric sclerosis of the lung tissue is present, dulness may be well marked. On the other hand, all these signs may be absent or indistinctly developed. In one of my cases, that of a young man of twenty-five, percussion did not reveal the slightest tangible assistance toward diagnosing and localizing the disease.

The same is true of auscultation. We hear soft crepitant as well as louder sonorous râles at various places, particularly over the posterior and lower part of the chest, when there is sputum present in the cavities, we hear amphoric and bronchial breathing here and there after thorough expectoration.

The fact that these auscultatory findings are not infrequently transmitted, and well audible over the unaffected side, makes the diagnosis on *this* basis extremely difficult. Still, on close and repeated examination, the quality of the sound, in conjunction with distinct circumscribed bronchial breathing, will guide us in properly localizing the trouble.

The history of the case also will here render useful assistance. Some patients have had frequent pain in one side of the chest only, sometimes accompanied by fever, most likely the clinical expression of localized pleuropneumonia with consequent adhesion formation,—or they have gone through a severe attack of unilateral pneumonia at one time or another of their life, which marks the starting of their trouble. This was the history in almost every one of the cases I have observed and has been found to be a most valuable aid in rendering the diagnosis.

The vocal fremitus shows no characteristics in this trouble.

Radiography, too, this most valuable factor in establishing the correct diagnosis in thoracic disease, particularly when done stereoscopically, is of comparatively little value in bronchiectasis. All authors agree that it is not safe to place too much faith in the shadows of the X-ray plate in this particular trouble. The extent of the disease can hardly ever be made out with its help. In one of my patients the rosary-like condition of the early subdivisions of the main bronchus were beautifully demonstrated.

Inasmuch as it has been shown of late that the injection of a few

ounces of antiseptic fluid into the bronchi in the shape of a spray or small stream is well-borne, without the occurrence of an aspiration pneumonia, I would propose and soon expect to try insufflation of collargol into the depth of the trachea and bronchi after the patient has thoroughly expectorated. In this way we may perhaps enable the radiographist to show more distinctly the contours of the walls of the distended bronchial cavities, same as is the case in urological surgery with pyelography (see below, under treatment)

Aspiration with needle and syringe is not recommendable. But *in the course of operating* (pneumotomy) the aspirating needle is the guide to reach the cavities.

A review of these brief remarks might lead one to ask quite properly: How then can the diagnosis of bronchiectasis ever be made? The question would be justified if our daily routine of clinical examination were our only means for reaching a diagnosis. But we have the history of the case as a guide, also the well-known method of exclusion to aid us in establishing the diagnosis.

In general it can be said, that patients suffer most likely from bronchiectasis who are expectorating quantities of mucopus or pure pus, sometimes mucus with streaks of or with larger quantities of blood, following paroxysmal attacks of coughing, who complain of night sweats and fever and show the clubbing of fingers—in short, patients with all the well-known subjective symptoms of pulmonary tuberculosis, but with a continued negative result as to tubercle bacilli. That probability is increased by a foul odor and taste of the sputum and by the development of the disease in the trail of a pneumonia which was caused by aspiration or otherwise. More precise points must then be brought out by daily clinical examination.

The real difficulty lies in making the diagnosis in the incipency of the disease. Further knowledge is required to enable us to render a definite diagnosis in the early stages of the trouble. For in this disease, as in so many others, the early diagnosis is the keynote for a satisfactory result of our therapeutic measures.

Course—The course of the disease is chronic. Death is oftener due to complications, than to the trouble itself. Strange to say, not a few patients die from abscess of the brain, sometimes also of the cord, or very acute suppurative meningitis. Tuffier lost 6 of his 45 patients from brain abscess. I had three deaths from acute suppurative meningitis in my ten cases. The symptoms of the latter disease were unmistakable in my patients, although I was unable to obtain an autopsy to corroborate the clinical diagnosis. The cause of this affinity

of the septic bacteria for the cerebrospinal system is not yet known. It certainly cannot be looked upon as a simple septic metastatic process. Thoracic infections seem to have a tendency to secondary acute inflammations of the central nervous system. In 1888 I reported a case of internal œsophagotomy in a child that developed acute meningitis, followed by death, five days after operation. Prof. Aschoff, of Freiburg, has the following to say about this peculiar phenomenon:

“Regarding the appearance of brain abscess in bronchiectatic suppuration, we are unfortunately not able to give a plausible explanation. We only know that the bronchial secretion contains myeline substance in abundance, bronchial and alveolar epithelia have the tendency to produce myeline of a special kind, as has been shown by Virchow. It might be possible that in consequence of this the microorganisms of the bronchial secretions, whenever they enter the circulation, gain a predilection for the central nervous system which is so rich in myeline. On the other hand, it is well known, and I personally have seen cases of carcinoma in the bronchial tree, in which metastatic cancerous elements were directly transported—by way of the costal lymphatics—into the subdural space and the meninges. In view of this, it may well be possible, that in the case of bronchiectasis or pneumonia, the meninges of the cord and brain become infected by way of the lymphatic vessels. Perhaps also the special class of microorganism might come into consideration. It is well known that pneumococci, and those related to this type, have a great tendency to infect the meninges as well as the brain itself, *e g*, otitis media, meningococci, etc.” (Private communication.)

That pneumonia and gangrene may set in, has been mentioned above.

Pulmonary hemorrhage although sometimes severe, has rarely been the cause of death (Kummel saw one case).

Perforation of a bronchiectatic focus into the pleural cavity with the prompt appearance of an acute pyopneumothorax has been fatal in every instance (Korte four cases, Kuttner and Sauerbruch one each).

The chronic suppuration and absorption of toxins produce amyloid degeneration of the kidneys and other parenchymatous organs, also myo- and endocarditis, the disturbance of the pulmonary circulation may cause dilatation of the right ventricle and weakness of the heart.

Toxin absorption with entrance of bacteria from the fauna always present in the bronchiectatic cavities by way of lymph- or blood-vessels, may give rise to painful recurrent joint affections in milder cases, or to the development of liver abscess and general sepsis.

Heidenhain observed one case of cancerous degeneration of the lung as a result of an old bronchiectatic affection

Treatment—To-day it is generally recognized, that a somewhat advanced, viz, a well developed, bronchiectasis is a surgical and not a medical disease. After operation, internal medicine, laryngology and surgery join hands. Hygienic régime of any kind, and open-air treatment so helpful in tuberculosis, are powerless in this affection of the bronchial system. An active therapy becomes imperative as soon as the diagnosis has been made. That milder, non-operative methods will be most effective, if brought into play early, stands to reason. That, however, implies "early diagnosis," the great difficulties of which have been dwelt upon above. Yet, there can be no doubt that progress will soon be made also in this respect, and the efforts of all interested should be bent in that direction. By means of frequent publication the attention of the profession should be called to the necessity of careful differentiation in the diagnosis of pulmonary diseases. Particularly should it be pointed out that the persistent absence of tubercle bacilli, in the sputum of patients whose trouble otherwise makes us think of the presence of a tuberculous affection, clearly points to bronchiectasis, and that it means—to say the least—loss of time to those individuals to be sent to a sanatorium for consumptives. The particular variety of bacteria with their toxins in the blood of these patients evidently and fortunately seems to counteract the entrance of the tubercle bacillus into the system. Otherwise it cannot be understood why these patients, offering so many opportunities for the entrance of the bacillus, particularly when detained in sanatoria, should not develop tuberculosis as a complicating disease. Yet, this, it seems, has never been observed.

As matters stand to-day, the majority of these patients are treated on general principles for many years, before active local and operative measures are employed. They are usually referred to the surgeon when all the advanced symptoms, enumerated above, have fully developed, when the elastic fibres within the walls of the many cavities have been totally destroyed and calcareous deposits have transformed them into unyielding "cess-pools." The difficulty of establishing a strict diagnosis is ostensibly the principal cause of the fact, that these patients are referred for proper treatment in an advanced stage of the disease.

The second contributive cause for the usual delay is to be found in the unsettled condition, up to the present time, of the proper development of therapeutic measures and particularly of operative inter-

ference. However, the indication for the various procedures is rapidly becoming clarified, and the very near future is bound to see a great advance in this respect. Specialists everywhere have become interested in the disease. The old lethargy is rapidly disappearing and giving way to a clear conception of what is best suited in the individual case. Nevertheless, as long as the operations so far devised cannot show definite and permanent cures, and the radical ones must still be considered as very dangerous, it is to be expected that patients whose bronchiectasis has been diagnosed in the earlier stage, will not readily give their consent to the performance of such operations. On the other hand, the statistics of these operations will improve as soon as a greater number of surgeons, working along these lines, have had an opportunity of operating in the earlier stage of the disease.

Korte, a few years ago, formulated the indication for operation in these cases by stating that "these patients must be operated upon, (1) as soon as the putrefaction of the secretion within the cavities has made them socially impossible, (2) in the presence of serious complications, the latter comprising fever, night sweats, recurrent attacks of aspiration pneumonia, severe hemorrhages, cachexia."

In the light of the progress made within the last years, these indications will soon be radically modified, in fact, they have already been extended, inasmuch as the necessity of aggressive treatment also in the early stages of the disease has been recognized.

At the present time, in early cases, the treatment should be carried out progressively, *i e*, beginning with milder measures, carefully observing their effect, and, if unavailing, resorting to more and more heroic treatment, finally resorting to one of the various intrathoracic operations devised. In advanced cases the latter have to be considered from the start. The only drawback at the present moment is the difficulty in selecting an operation which is effective and does not involve too great risk. For, it will have to be the surgeon's first task to show a low mortality in these operations. Only in this way can the absolutely necessary confidence of profession and laity in thoracic work of this chapter be gained, and wholesome progress be guaranteed.

Briefly reviewing what is known to us in the way of useful, active therapy in bronchiectasis to-day, one may classify as follows

I *Non-operative Treatment*

- a By way of the alimentary canal—thirst cure
- b By way of the circulatory system—intravenous injection of colloidal silver

- c By way of the respiratory system—(1) inhalation of super-heated air with admixture of suitable drugs, (2) direct intrabronchial application of drugs per syringe or spay

II *Operative Treatment*

- a Extrapleural—(1) thoracoplasty, (2) pneumolysis
- b Intrapleural—(1) therapeutic pneumothorax—insufflation of nitrogen, (2) incision of lung—pneumotomy, (3) transposition of lung by means of suture fixation, (4) ligation of branches of the pulmonary artery, (5) extirpation of the diseased portion of the lung
- c Intrapericardial ligation of either main branch of the pulmonary artery (still in experimental stage)
- d Diaphragmatic—paralysing one side of the diaphragm corresponding to the diseased lung by resection of the phrenic nerve at the neck (phrenicotomy)

The operative treatment should also be considered from the following points of view

A Pneumotomy for draining the suppurating cavities

B Operations done to compress the lung (collapse-therapy)
(1) By creating therapeutic pneumothorax—nitrogen insufflation, (2) pneumolysis with or without introduction of a plomb, (3) thoracoplasty combined with, or without (4) phrenicotomy

C Operations done to influence the pulmonary parenchyma, producing contraction plus carnification (1) Transposition of the lung, (2) ligation of branches of the pulmonary artery, with or without subsequent thoracoplasty, pneumolysis and phrenicotomy—intrapericardial ligation of the first divisions of the pulmonary artery

D Amputation of the diseased lung

The latter subdivision is referred to below

I Non-operative Treatment—a *Thirst cure* Singer (*Wiener Med Woch*, 1913, N 24) recommends a systematically carried out ‘thirst cure’ in order to reduce the amount of expectoration in bronchiectatic patients. The total amount of fluids allowed within 24 hours is slowly decreased to 200 c c. Two “wet days” a week with 1200 to 2000 c c of fluid are interposed. Sweat baths, gradually added produce further reduction of the quantity of the sputum. The use of chewing tablets, lime preparations internally on account of their anti-inflammatory effect, and inhalation of oxygen, are valuable aids in this heroic treatment. Singer publishes eight cases showing the good results obtained with this thirst cure. I am at present testing it in one of my own patients, but am not yet ready to report

b Intravenous injection of colloidal silver (elektargol), in early cases of localized bronchiectasis and pulmonary gangrene, is mentioned merely for the sake of completeness. Only one case reported (*Fortschritt Med*, 1913, p 757). First collargol-solution 0.1 per cent, table-spoon doses, given repeatedly per os for two weeks, to stop vomiting, caused by swallowed fetid sputum. Then electargol intravenously, 18 injections of 5 c.c. each in ampuls), every second day. Temperature dropped, sputum decreased, no longer mixed with pus. General condition improved.

c (1) Inhalation of superheated air with an admixture of suitable drugs. In the spring of 1913 I had at one time five patients with bronchiectasis under my care, three males and two females. The former had been operated upon previously by me with ligation of branches of the pulmonary artery. Two of them returned to have secondary thoracoplasty added. The two females were yet to be operated upon. Just then Elsaesser published his paper on the beneficial effect of superheated air inhalation for certain affections of the respiratory system¹. He employed the well-known electric hot-air douche, called "Foen," which he supplied with a device for admixing suitable drugs to the hot-air current. The same idea had been tried as early as 1888 by Weigert and Halter² and they claimed to have obtained good results in lung tuberculosis. Of late a number of others have investigated its effect. Thereby encouraged, I induced some of my patients to try it. Three of these patients soon got tired of using the inhalation. One saw no improvement and later died of acute suppurative meningitis, one, who had the branch of his pulmonary artery tied, has faithfully continued the use of the medicated hot-air current for the past year and is very much improved. The method seems to deserve recommendation in conjunction with surgical therapeutic measures.

c (2) Intrabronchial application of drugs by means of catheter with syringe and spray. This method goes one step further than the preceding one. Useful drugs are applied directly where their application is desired. This treatment dates back to 1904, when Jacob, Bongert and Rosenberg published their experience and clinical studies which they had made at the Clinic for Internal Medicine at the Berlin University. They used a catheter which was passed through the glottis into the trachea. In 1910, Ephraim described his ingenious device for intrabronchial spraying³ (see Fig. 1) and last year, Guisez published his

¹ D. Med. Woch., 1913, p. 118.

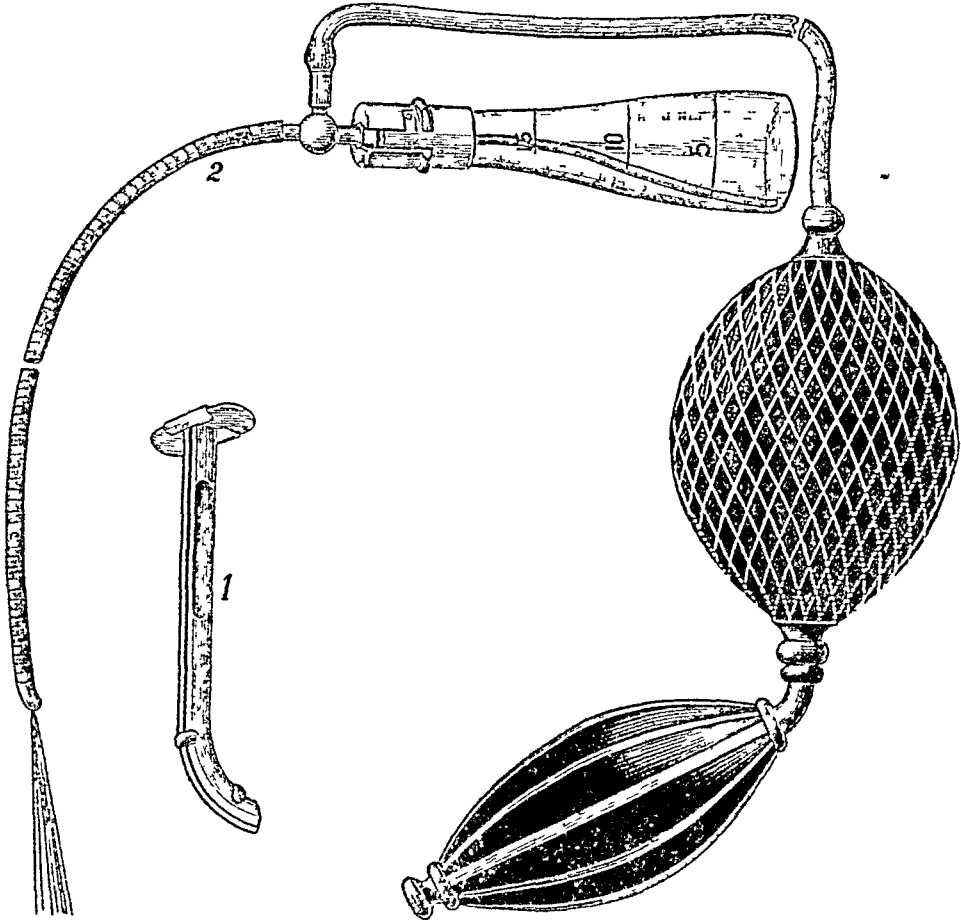
² Berl. Klin. Wochenschr., 1888.

³ D. M. W., 915 and 2266, also 1911, p. 2079 and 1912, p. 1450.

method of injecting drugs,⁴ very similar to that of Ephraim. Under the guidance of the laryngeal mirror, a long, curved cannula is passed into the lower trachea and 20–25 c.c. of the medication are injected by means of a syringe. He asserts that the entire pulmonary parenchyma becomes permeated with the fluid within a few minutes.

These methods have not yet received the recognition they seem to deserve. It will be necessary for the laryngologist to acquire the technique and join hands with the internist and surgeon in combatting some of

FIG. 1



Ephraim's apparatus for endobronchial treatment by means of spray 1, cannula for introduction (can be taken apart)

the symptoms of this Proteus-like disease. However, these non-operative methods can be of lasting benefit only when applied in the beginning of the trouble, it is clear that they cannot influence or improve the pathological changes of the walls of the bronchi. In the more advanced cases they can, therefore, play but a secondary rôle, that of adjuvants to operative treatment.

⁴ Bull. et mem. de la soc. méd. des hospitaux de Paris, 1913, N° 29, p. 573

As stated above, collargol with its strongly antiseptic qualities might be made use of to advantage for such intrabronchial application. In addition to its antiseptic effect, it might, as mentioned, perhaps assist the radiographist in bringing out more clearly the contours of the distended bronchi, same as is done with the pelvis of the kidney in pyelography.

Operative Treatment General Remarks—1 Preparation of the Patient It is advisable that the patient, for a few days before operation, retain, as much as possible, a posture which favors the emptying of the bronchiectatic cavities, *ie*, lies on his right side when the disease is in the left lung and *vice versa*. In addition, we keep the patients in a knee-elbow posture for an hour or two immediately preceding the operation, and make them cough out thoroughly, before placing them on the operating table. This reduces the danger of aspiration pneumonia.

2 Anæsthesia The danger of the occurrence of aspiration pneumonia makes general anæsthesia inadvisable, except for short periods. Regional and local anæsthesia are preferable. Corresponding to the ribs to be resected and to the site of the intercostal incision, the respective thoracic nerves are previously infiltrated with $\frac{1}{2}$ to 1 per cent novocaine—adrenalin solution. Then the line of incision is prepared in the same manner. 10 to 15 minutes at least should be allowed to pass, before proceeding to cut. Even in excited patients the work is now nicely feasible. But the narcotizer must be on hand, now and then a few whiffs of a general anæsthetic may be required, sometimes a mock anæsthetic of alcohol plus water in equal parts suffices. For the incision of the pleural cavity, however, a brief superficial general anæsthesia is advocated, in order to avoid the reflex cough and straining on the part of the patient during expiration.

3 Differential pressure apparatus The advantage of having various types of apparatus to select from becomes manifest in this instance again. The apparatus is adapted to the patient, and not the patient to the apparatus. It is the consensus of opinion, that in this kind of operations it is best for the patient to have the mouth free and unencumbered, the patient is constantly urged during the operation to expectorate and, of course, must be able to do so. That calls for the use of a positive pressure cabinet, or a negative chamber. Of the two the negative pressure is preferred, because it makes expectoration easier and lessens the danger of aspiration. At all events some kind of differential pressure apparatus should be ready for use, because

there may be no adhesions whatever between pulmonary and costal pleura, in spite of many years of sickness. Personally, when operating on these cases, I have the differential pressure apparatus in readiness, and turn on the pressure when it appears that adhesions are missing.

Operative Treatment Special Remarks—A Pneumotomy This operation is indicated in cases in which a circumscribed bronchiectatic disease of the lung could be diagnosed clinically.

As the first step, a wide resection of a number of ribs (2-3) that overlie the cavity, with their intercostal tissues is essential. Then the aspirating needle (medium size) is introduced, until pus is found.

Be it remembered, however, that it is best not to push the needle forward until after the costal pleura has been divided, to make sure that adhesions are present. In one of my cases I assumed such adhesions as a matter of course, in view of the long duration of the disease, but when using the cautery alongside the needle in order to open the abscess, the free pleural cavity was entered, and at this moment the syringe, which was held by the assistant, slipped off the needle which had no thread (Record) nor bayonette arrest. The patient coughed and some pus spurted out of the needle and dropped into the open pleural cavity. Drainage of the latter became necessary, complicating and retarding the patient's convalescence. If no infection of the cavity had occurred, immediate suture of the lung to the costal pleura would have been indicated. Be it further remembered, that *aspiration of air* into the barrel of a *well-working* and previously tested syringe, is just as significant and pathognomonic for the presence of cavity formation, as that of purulent material. As stated above, we insist upon our patients' emptying their bronchiectatic cavities as far as is possible before operation. We consequently must expect to have many of them filled with air rather than fluid material.

Alongside the needle, as a guide, the lung is freely incised with a knife, better with a cautery. Sometimes the sought-for cavity is found in considerable depth, in some of Lenhartz's cases as deep as 20-26 cm (8-10 inches) below the surface of the chest.

A free lung incision is indispensable in cases in which the cavities are not far from the surface, in order to be able to cope with a hemorrhage. Large blood-vessels may be encountered and we must be able to ligate them if injured. If the cavity is deep, knife and cautery must be laid aside and gentle and careful progress made with a blunt, straight dressing forceps, for, the nearer the hilus of the lung, the larger are the branches of the pulmonary vessels. Aspiration of air with subsequent

air embolism has been observed in case of injury to these blood-vessels. When the cavity has been struck, boring with the finger and other manipulations in the dark are to be avoided, drainage with rubber tube and additional tamponade with iodoform gauze follows. The wound must heal as in other abscess cavities. That a liberal excision of the chest wall greatly favors this has been mentioned before.

If, during operation, it is found that adhesions are absent, and the free pleural cavity is entered, the question may come up whether a two-stage operation is advisable. For many reasons the surgeon should try to finish the work in one sitting. With the patient under differential pressure he has time and tranquillity of mind to carefully palpate the lung. Not infrequently an infiltration will show the seat of the trouble in the depth. This area is stitched to the costal pleura, best with Roux's suture (a continuous mattress stitch which always re-enters at the last exit of the needle, same as some operators use it for the skin and glabella in brain surgery according to Heidenhain), and then opened as it was described above in the presence of adhesions. Only in very weak patients should the two-stage operation come into consideration, viz., resection of the chest wall, with the application of chloride of zinc or with gauze tamponade as the first step, followed one to two weeks later by lung incision.

It should be emphasized once more, that pneumotomy as the *first step* is indicated only, or at least principally, for the drainage of one larger bronchiectatic cavity. With sufficient mobilization of the chest wall, results may be very gratifying. In May, 1913, I was able to present a young lady, who had suffered from circumscribed bronchiectatic abscesses, treated in this way, before the N. Y. Surg. Soc. (ANNALS OF SURG., 1913, p. 700). Here the right upper lobe had been the seat of the focus, which latter was the result of an aspiration pneumonia, following an abdominal operation.

If the disease is spread over a large area, prolonged drainage to the surface of the thorax will reduce the quantity of expectoration as long as drainage is free, but with the contracting wound, the temporary improvement may be lost and a permanent bronchial fistula with insufficient drainage become established. In the three cases under my own observation, who died from acute meningitis, this latter complication set in when the drainage wound contracted. This may have been a mere coincidence, on the other hand, it may also have some significance.

In exceptional cases pneumotomy may be indicated in spite of a more diffuse affection, because prompt free drainage of the bronchial tree

downward to an external wound appears imperative in order to reduce the intrabronchial putrefaction. Thus one of my patients, a young girl of twenty, with a diffuse affection of the left lower lobe since childhood, who for two years had been condemned to solitary confinement on account of the terribly foul odor of the expectoration, was a few weeks after operation so much improved that she could re-enter the ward.

Greater difficulties present themselves to operative therapy, if multiple larger and smaller bronchiectatic cavities are present in one or several lobes of the lung. It is evident that pneumotomy cannot fulfill the just indicated primary need.

B The next possible step in our present status of operative interference is collapse-therapy. This, as stated above, can be accomplished (1) by the production of a therapeutic pneumothorax, by means of nitrogen insufflation, as used in pulmonary tuberculosis, (2) by pneumolysis with or without introduction of a plomb, (3) by thoracoplasty (multiple rib resection) with or without (4) phrenicotomy.

(1) *Artificial pneumothorax* Artificial pneumothorax has entirely failed in cases in which the trouble was at all advanced. The former symptoms returned unmitigated when the insufflation was discontinued, even though it had been permanently practised for a number of years (Volhard one case, 2 years' treatment. Schmidt, on basis of 8 cases, also pronounced the method a bad one). In view of the experience so far had with nitrogen insufflation, it cannot, therefore, be recommended as a means of cure or even permanent improvement in somewhat advanced cases of bronchiectasis.

(2) *Pneumolysis plus introduction of a plomb* The latter will permanently and equally compress the lung. Subperiosteal resection of a piece of rib, about 7-10 cm (3-4 inches) long, careful splitting of the posterior layer of the periosteum with underlying intrathoracic fascia. Blunt division of the latter from the next layer, the costal pleura, which will gradually afford an entrance into the chest for 3-4 fingers of the operator's hand, and enable him to loosen the lung from the inner surface of the ribs, without opening the pleural cavity. The big cavity thus created is then filled with fat, extirpated from another part of the patient's body or a lipoma, or omentum, kept in cold storage (Tuffier), or a paraffin plomb is introduced (Baer, Jessen, *Muench Med W*, July 22, 1913). It is evident that in this way the compression of the lung is accomplished in an effective, because permanent, way. The operation is not a serious one. In Tuffier's series of cases, 20 in number, recently published by Lenormant, there was no mortality.

All cases were improved, but none cured (*Presse Méd*, 1913, vol. *xxi*, p. 786)

(3) *Thoracoplasty* Another useful surgical intervention, though perhaps somewhat less effective, is multiple rib resection (*thoracoplasty*) with the help of raising a skin muscle flap or of Sauerbruch's hook-incision or Wilms' columnar resection. Quite a number of ribs are excised under regional and local anæsthesia, as above described. The wounds are sutured, with rubber tube drainage. Primary union usually sets in. The effect sometimes is splendid. Graser recently reported what looked like cures in two cases operated upon in this manner. Sauerbruch repeatedly saw great improvement. I had one case cured (see above). But these results are exceptions. The majority of authors agree that, as a rule, improvement only can be expected of the method. This has also been my experience in two cases, one of total thoracoplasty done in three stages, after ligation of the branch of the pulmonary artery which feeds the right lower lobe, the other after resection of the left sixth to tenth ribs following ligation of the pulmonary branch for the lower lobe of the left lung. The impossibility of a *cure* by these means in advanced cases can be readily understood, even with additional

(4) *Phrenicotomy* Resection of a piece of the phrenic nerve at the neck, by which half of the diaphragm, on the diseased side, is artificially paralyzed⁵

As has been said in the beginning, bronchiectasis is a disease of the bronchial tree, and not of the pulmonary parenchyma. Cavities of the bronchi, especially the larger ones, with their hard, often calcified walls, cannot be influenced by any amount of compression or collapse of the lung. The smaller cavities, however, will be greatly improved by the collapse of the alveolar tissue, and catarrh as well as retention of secretion will be much reduced. This, in turn, improves the discharge from the larger cavities, lessens decomposition of the formerly stagnant secretions and reduces absorption of toxins which had kept up the vicious circle of poisoning the system. The patients' general condition consequently improves.

In bilateral bronchiectatic affection, thoracoplasty is contra-indicated, because expectoration may become greatly interfered with, if a number of ribs are removed on both sides of the thorax.

Recognizing the limitations, in advanced cases of multiple cavity for-

⁵ It has been seen after this operation, that the dome of the unilaterally paralyzed diaphragmatic muscle rises up to the second or third rib and thus compresses the lung from below *ad maximum*.

mation, of pneumotomy and the collapse-therapy, surgeons evolved more radical operative means to be combined with thoracoplasty

C (1) Thus Garré, after liberal rib resection, mobilized the lower lobe of the lung by lifting it entirely out of the complementary space and transposed it upward, after it had retracted toward the hilus. The border of the lobe is stitched on to the convexity of the diaphragm and the complementary space allowed to close under tamponade. A marked improvement in the patient's condition was seen. In another case, treated by Garré the same way, an extensive secondary pneumotomy became necessary and finally the entire lobe had to be extirpated.

(2) Sauerbruch tried to produce carnification of the lung tissue by a different, very ingenious procedure, already referred to above. On basis of experimental work which he had done in conjunction with Bruns, he ligated the respective branch (or branches) of the pulmonary artery which carries blood to the lung *for aeration*. The abolishing of its physiological function brings about the atrophy and gradual carnification of the lung tissue. Far-reaching connective tissue proliferation occurs and the pulmonary pleura becomes adherent to the costal. If then, after some time, thoracoplasty and, in cases of disease of the lower lobe, cervical phrenicotomy are added, pronounced carnification plus compression has been accomplished. Sauerbruch has carried out the ligation of branches of the pulmonary artery on this indication seven times, I myself have done it three times and H. Morriston Davies of London once (*British Journal of Surgery*, vol 1, No 2, 1913, page 250). All the patients recovered from the operation. Respiration and heart action were never interfered with. The operation is not a serious one. All patients were improved, some very materially, none lost the expectoration entirely. At best the sputum was reduced to 20-50 c c (1-2 ounces) in 24 hours.^o

INTRAPERICARDIAL LIGATION OF THE FIRST DIVISIONS OF THE PULMONARY ARTERY

The ligation of the branch of the pulmonary artery feeding the diseased lobe is not always an easy operation technically. On account of

^o A new and effective way of producing profound collapse and atrophy of pulmonary tissue has been devised by Henschen of Zurich. At the last meeting of the International Surg. Congress in New York, April, 1914, he pointed out that, according to his experimental work, total atrophy of the affected lower lobe of the lung was produced by its subdiaphragmatic transposition in combination with and rendered possible by artificial paralysis of the diaphragm on the same side, by means of phrenicotomy. Further experimental experience followed by practical tests of the method in man will have to decide its usefulness.

dense adhesions it may prove difficult to enter the interlobar space where the artery must be found and tied. Injury of the lung tissue and smaller bronchi with exit of infectious material may thereby occur. There are many anatomical variations.

In view of these facts, the writer proposed last year, on basis of experimental studies, particularly in affections of the right middle and lower lobes, to reach and tie the right pulmonary artery, viz., the first division of the main trunk within the pericardium.⁷ In the dog this operation is fairly easy, and in all probability will not be very difficult in man, at least as far as the left pulmonary artery is concerned. In order to reach the right main trunk in man, a trap-door incision of the sternum appears necessary,—a somewhat complicated preliminary operation.⁷ The right pulmonary artery is best ligated within the pericardium between the descending vena cava and ascending aorta. If these two vessels are held apart, the artery is met with in the depth on its transverse course, posteriorly to the two vessels named. However, this very place is covered by the body of the sternum. It is possible, and seems plausible, that this work might be facilitated and access to this spot more conveniently gained with the help of longitudinal splitting of the sternum.

The cause of the failure of all these methods to effect a real cure, has been repeatedly dwelt upon above. If they are to be truly effective, they must be carried out *before* the walls of the larger bronchiectatic cavities have become rigid. In other words, they must be done in the earlier stages of the disease. Be it therefore repeated and emphasized once more. The combined efforts of all interested will have to be directed toward proving by favorable operative statistics, that an established case of bronchiectasis is a surgical disease, which had a chance of a cure by milder operative methods only, if without delay an aggressive therapy had been employed against the first manifestations of the disease. Meanwhile we have to deal with the facts as they are. All the patients with bronchiectasis reaching the surgeon to-day are advanced cases. Our operations have so far only improved their desperate condition. If we want to be certain to effect a cure, there is only one procedure that can be considered, namely .

EXTIRPATION OF THE DISEASED LOBE (PNEUMECTOMY)

The operation is one of magnitude, principally on account of, first, the vagus reflexes in handling the bronchus near the hilus, second, the

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possible strong adhesions in this region when the disease has been of long-standing, third, the tendency of the bronchial stump to slip back when no adhesions are present, and fourth, the deadly "pressure-pneumothorax," if the pleural cavity was thoroughly closed after the extirpation, but the occluded bronchial stump leaks. A further problem is presented by the difficulty of closing the bronchus air-tight, if the separation of the large blood-vessels accompanying it and their isolated ligation cannot be carried out. If isolation and ligation of the vessels is feasible, as it will be in favorable cases with the bronchiectatic affection confined to just one lobe and missing pleural adhesions, I firmly believe that the method which has given me such uniformly satisfactory results in dogs, viz, crushing of the bronchial cartilages with a strong clamp—Doyen's intestinal crusher—with inversion of the tied stump and a number of top sutures (*Centralbl f Chirurgie*, 1909, No 50), will prove to be a safe procedure in making the bronchus air-tight also in man. Wedge-shaped excision of the lung tissue towards the bronchus after the tying of the main vessels, division of the bronchus before it is crushed and treatment of its mucosa by means of scraping with the curette and disinfection with pure carbolic and alcohol, or with the Paquelin cautery, and stitching the small amount of retained lung tissue over the ligated and inverted stump, will be important additional factors in making for success.

So far 16 cases of pneumectomy for bronchiectasis have been reported.

Seven of these were done in the presence of far-reaching adhesions, with six recoveries and one death.

Three were done without the presence of adhesions between pulmonary and costal pleural, with one recovery and two deaths.

In six cases no statement is made regarding pleural adhesions. Of these one recovered (improved), and five died.

Total 16 cases, 8 cured or improved, 8 died.

Let us hope that the statistics will soon improve by persistent work along these lines and that we shall learn how to overcome the technical difficulties and dangers to the patient in this clearly indicated and proper radical procedure.

Summing up I would say

If a patient comes to the surgeon to-day with a well-developed diffuse bronchiectasis and asks for relief, he should be told that at the present moment we have two operative methods of treatment at our disposal. The one entailing comparatively little risk, and to be done in stages, will

change the anatomical structure of the lung and make it collapse, but in all probability will only improve the trouble to a greater or less extent, while the other one, consisting in extirpation of the diseased lobe or lobes of the lung, if successful, may cure, but is still a dangerous procedure. The patient or his guardian must decide which course should be followed. It is to be expected that the majority will select the first procedure. Pneumectomy, then, always remains as a last resort, should the less serious operations fail to bring sufficient relief.

THE SURGICAL ASPECTS OF BRONCHIECTASIS *

BY JAMES G. MUMFORD, M D

AND

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It is rather extraordinary that three contributors to this important symposium on thoracic surgery should have chosen independently to discuss bronchiectasis,—a disease with high mortality in surgical annals, and one admittedly chronic from the point of view of the internist

The importance of a disease should be estimated quite as much by its disabling power as by its mortality. Probably our interest in bronchiectasis results from a desire to relieve a disgusting and disabling malady, to restore to efficiency a chronic invalid, and to reinstate among society an individual ostracized by the ever present accumulation of a profuse and generally offensive expectoration. With this picture you are familiar. A man or woman, and not infrequently a child, somewhat emaciated, generally anæmic, reticent, tired, practically useless, and preferring isolation. In the clinic you gather the students around this pitiable curiosity, passing him a porcelain cup. Even the ignorant foreigner solves your meaning, and by means of any number of several gymnastics empties his chest into the cup and returns it to you under the astonished gaze of the student, who has received a lasting impression. But this is the picture of an advanced case. In the beginning the diagnosis is rarely made, often the patient is late in consulting.

My limited knowledge of bronchiectasis is based on the study of twenty hospital and private cases. I have learned something from the literature, essentially the German, and particularly from the discussions at such meetings as this of the German Surgical Congresses. Text-books contribute little, monographs are rarely devoted to bronchiectasis alone, a fragmentary share is devoted to this subject in papers on pulmonary diseases and their treatment.

The causes of this disease are varied and uncertain. I recall two originating in whooping-cough, another from measles, three from inhalations of a lamb bone, part of a toy balloon, a tooth. Acute influenza and influenza bronchopneumonia are probably most significant in etiology. Chronic empyema is said to be a forerunner of bronchiectasis.

* Read before the American Surgical Association, April 10 1914

Obstruction at some portion of the respiratory tract from foreign body, tumor, or disease, is doubtless generally contributory. But whatever may be the exciting cause, the influenza bacillus is generally, and I am tempted to say universally, present in the sputum.

No group of physical signs are typical of bronchiectasis. I could cite to you auscultation and percussion findings of several cases of bronchiectasis, the interpretation of which might be entirely consistent with empyema, pleurisy with effusion, chronic abscess, malignant disease, or actinomycosis.

Röntgenologists are insulted if told that the X-ray is valueless. When the etiology, history, and sputum examination shout the diagnosis of bronchiectasis, a plate may sometimes show a large cavity if previously emptied of secretion. This is thrilling, and converts the case into a so-called "beautiful" one. But when all signs and symptoms are confusion and subject to many interpretations, and we rush to the X-ray specialists, he cannot differentiate for us. He will demonstrate any or all of the complex of signs which the stethoscope has prophesied, but he is of little consolation in our dilemma.

Let the text-book writers then confess that the stethoscope and X-ray may be *confirmative*, but that the diagnosis must be made chiefly by exclusion of allied diseases, by the etiology, by the history of repeated winter colds resembling bronchopneumonia, by the nature, persistence and quantity of the sputum, and by the presence of influenza bacilli.

In discussing treatment we will begin as usual by attacking the internist. He tries to effect a cure. Medicine fails, inhalation soothes, change of climate reduces the secondary bronchopneumonia attacks, hygiene contributes rather less than in other pulmonary diseases. If the surgeon says, "Let us have a try," the internist answers, "What have you done? What can you do? My patient is still alive, he is not suffering."

In answering this question I choose to divide the surgery of bronchiectasis and of several thoracic diseases into two chronological periods: the first up to 1904, the second since 1904, or the past ten years. The surgical results of the first period might well discourage the internist from transferring his cases of bronchiectasis.

Mosler in 1873 excised five inches of the fourth rib, opening a cavity. The patient died. Autopsy showed other cavities undrained. Leyden and Koch in 1882 drained two cases, one died, the other improved. Biss and Marshall in 1884 operated for drainage. Death followed. Multiple cavities were found at autopsy. And so on. We read a long story of drainage operations in 33 cases with mortality of 62 per cent.

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In other words, the surgery of bronchiectasis up to 1904 consisted essentially in drainage operations. When death did not follow operation, the condition generally remained unrelieved because of the multiple undrained cavities remaining. Those types of bronchiectasis not associated with cavity formation were not relieved, and many such cases died as a result of search for cavities which were not there.

The recent period of ten years witnesses certain developments. Nitrogen gas injected into the pleural cavity produces and maintains collapse of the lung. This artificial pneumothorax has been successful in phthisis. The technic is perfected. It is being employed in diffuse bronchiectasis.

Extensive rib resection—the pleuropneumolysis of Friedrich—has been employed to collapse the lung. Cases of bronchiectasis thus treated are now recorded. Hence another therapeutic measure in bronchiectasis. Be the results what they may, we have a new direction of attack.

Ten years of persistent animal experimentation have established the technic of lung resection as a therapeutic measure in various diseases. During the first period before 1904 the applicability of resection therapy in bronchiectasis could not be tested, because of our reluctance to enter the pleural cavity in the absence of adhesions. Numerous methods have been devised to overcome the possible dangers of opening the non-adherent pleura. Intratracheal insufflation survives as the fittest method. Hence excisions of bronchiectatic lobes have been attempted, and an opportunity is thus offered to determine whether or not this excision may prove to be a successful method of attack. Experimenters have devised new methods of closing the amputated bronchus in the normal animal. Such technic may or may not increase the safety of lung resection in the diseased human lung, and yet the field is opened wider in the surgical therapy of bronchiectasis.

A fourth surgical therapy employed is restricting the blood supply to a bronchiectatic lobe. The pulmonary arterial branch is ligated. Shrinkage of the lobe results. This method may prove of great value, if not complete in itself, at least as a preliminary to excision.

The last ten years, then—those years of the last period—have contributed at least four methods of treating surgically bronchiectasis. The conscientious internist doubtless welcomed this advent, but still seeks to know whether the curative effect has increased. The remainder of this paper, then, will be devoted to a discussion of the more recent results of new therapy, and it behooves us to be conservative and accurate in our statements, not implying that our success is greater than it is.

Obstruction at some portion of the respiratory tract from foreign body, tumor, or disease, is doubtless generally contributory. But whatever may be the exciting cause, the influenza bacillus is generally, and I am tempted to say universally, present in the sputum.

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bronchiectasis Three years ago I described a reliable technic for nitrogen injection, and it is gratifying to see the progress of this pneumothorax therapy in America where it was originally presented by Dr J B Murphy

The third method of surgical attack is the one which has been regarded as the most promising, that of lung resection The complete or partial removal of one lung in animals is an acknowledged safe procedure, as I have often demonstrated In both the first and second periods of thoracic surgery, portions of the lung have been removed for malignant disease, actinomycosis, ecchinococcus cysts, abscess, and gangrene The technic of exploratory thoracotomy is improved The technic of treating the lung stump after amputation is improved The complete removal of a diseased portion of the lung in bronchiectasis seems to be the ideal method of eradicating a pathological condition, the structural changes of which may be regarded as beyond repair Only certain types of bronchiectasis, however, are amenable to the excision treatment It is comparatively rare to find one lobe only of the lung involved, and when more than one is diseased, excision must be abandoned, and one or another form of collapse therapy resorted to

Portions of the lung and even complete lobes have been successfully removed in cases of bronchiectasis Lenhart, Garrè, Korte, Krause, Kummell, and Sauerbruch have all reported one or two successes I have added one case, and Dr Willy Meyer doubtless has more to contribute to the list of successful lobe excisions A striking feature common to all but Garrè's case attracts our attention, namely, that the successful lobe excision followed a series of previous operations, and excision was eventually performed, not because it was the original intention of the operator, but because his first exploration and attempted drainage of the lung was followed by empyema, by contraction of the diseased lobe, by plastic operations on the empyema cavity, and yet without relief of bronchiectatic symptoms As a last resort the retracted lobe was excised successfully

Now this is not the brilliant form of lung excision which the success in animals prophesied An amputation at one sitting is the operation to which we have all aspired Many patients with bronchiectasis have been lost in the attempt to accomplish this Less than four have survived

And it is upon this point of radical one-stage operation *versus* the several stage procedure that controversy is bound to arise

As the surgery of the thorax advances I become more and more impressed with the unwillingness of the respiratory apparatus and the

Methods of establishing lung collapse are given much attention nowadays. In tuberculosis *lung collapse is effective*. Placing a phthisical lung at rest by collapsing it, tends to heal it. Connective tissue replaces tuberculous tissue in these cases and cicatrization obliterates cavities. This same collapse therapy is being tried in bronchiectasis. Symptomatic relief generally follows the collapse. The residual sputum content of cavities and dilated bronchi and alveoli is diminished for the time being. In early cases in young adults this treatment will be curative. But in the advanced cases where the pathology consists in an actual change of structure, I entertain grave doubts as to the curative effect of collapse. A bronchus once dilated with thinning of its walls is probably beyond recall. We then deal with a permanent deformity, and the alveolar emphysema and general ectasis of the terminal bronchioles are probably not to be restored to efficiency by mere immobilization and lack of use.

Nevertheless, we must never exclude lung collapse therapy, and I advocate its trial in every case as a harmless preliminary. There are two ways of collapsing the lung. Relaxing the chest wall by excising innumerable ribs will partially compress the lung. This is Friedrich's pleuropneumolysis operation. He insists that it is safe and effective, particularly in phthisis.

Luxembourg reports a successful result in this operation on a bronchiectatic case. I have tried it three times, with two deaths and one narrow escape. From three to four days following operation coughing is restricted by pain in the wounds. The secretions are incarcerated in the collapsed lung. They may reach the bifurcation and be reinhaled to the sound lung. Furthermore, that unexplained group of complications may occur which brings disaster in so many thoracic operations. It is a sudden combined insult to the respiratory and circulatory mechanism which frequently the individual cannot compensate.

Observe, however, that the safe method of collapsing the lung is by the injection of gas into the pleural cavity, thus producing artificial pneumothorax. It succeeds when the pleural surfaces are not extensively adherent. I grant that Friedrich does not advocate rib resection in preference to nitrogen injection, except in those cases where the adherent pleura prevents the entrance of the gas. But in view of the doubtful benefit of collapse therapy in these advanced adherent cases, and mindful of the dangers of rib resection, I believe that when nitrogen injection fails, rib resection should also be abandoned and then resection of portions of the lung alone should be considered.

Artificial pneumothorax, then, should generally be attempted in

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I believe that the preliminary retraction of the diseased lung may be accomplished by any of the previously mentioned methods of collapse therapy,—namely, rib resection, or artificial pneumothorax, or ligation of the pulmonary artery. Months later you may excise the lung. It is conceivable that all these methods may be superseded by the injection of fluid, not only to produce lung compression, but to produce adhesions of the lung in the contracted position, just as an infected pleurisy with empyema will produce the same result.

Of course the ambition of the thoracic surgeon is to perform amputation of the lobe of the lung as readily and successfully in the diseased human being as in the dog. His success in animals has given him a proof of the possibility of such a radical procedure. Perhaps the success of animal experimentation in this direction has been misleading, and that we must allow that lung excision in the diseased human being is a very different proposition, and one not to be executed in the same fashion. As regards bronchiectasis, then, I propose the following conclusions:

1. Granted that bronchiectasis is commonly the result of bronchial obstruction by foreign body, tumor, or disease, the first indication in therapy should be the removal, if possible, of this obstruction. Bronchoscopy for the removal of a foreign body has not infrequently arrested bronchiectasis.

2. In the earlier stages of bronchiectasis, nitrogen gas injection producing artificial pneumothorax is indicated, and should always be tried.

3. Pleuropneumolysis, or extensive rib resection, is a dangerous procedure, with additional dangers in bronchiectasis. It should be employed only when adherent pleura prevents the introduction of nitrogen gas. Even then it is a dangerous procedure, and one of doubtful value.

4. In late cases of bronchiectasis, when the disease is obviously confined to one lobe, lung resection is the sole hope of surgical cure. The attempt at lung resection at a one-stage operation has been attended with high mortality. Occasional successes do not prove that the one-stage amputation will become the method of choice. For the time being at least, the general surgeons should first produce compression of the lung by artificial pneumothorax or pulmonary arterial ligation, second, and much later, he should excise. Meanwhile let us hope that the student of *thoracic* surgery will develop the one-stage excision.

THE CHOICE OF ANÆSTHETIC IN OPERATING FOR ABSCESS OF THE LUNG *

REPORT OF TWO CASES OPERATED UPON UNDER LOCAL ANÆSTHESIA

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OPERATIONS in the intrathoracic cavity have been possible under physiologic conditions only since the introduction of the negative and positive pressure methods of Sauerbruch,¹ and Brauer and Peterson,² in 1904, and the intratracheal insufflation method of Meltzer and Auer³ in 1909

That remarkable progress has been and will be made in the surgical treatment of intrathoracic lesions, and that the advances will be dependent upon the proper use of some one of these methods, no one can question, but a sharp distinction should be made between intrathoracic operations in which the free pleural cavity will or may be opened and operations in which the pleural cavity will not be opened. Judged from the case reports and the general discussions regarding intrathoracic operations, it does not seem to me that this distinction has been sharply made

Success in the surgical treatment of non-tuberculous abscess of the lungs depends mainly upon four factors: the correct diagnosis, interference before the patient is so toxic as to be beyond relief, drainage without infection of the free pleural cavity, and avoidance of any factors which may tend to cause an extension of the infection to uninvolved portions of the lungs

A careful physical examination, together with the use of the stereoscopic X-ray plates, should lead to as definite a localization of the abscess cavity, except in most atypical cases, as is possible after intrapleural exploration of the lung

The result in cases operated upon as compared with those treated expectantly must more and more influence the time of operative interference. These results show that abscess of the lung untreated gives an 80 per cent mortality as compared with a mortality of 17.5 per cent⁴ with operation

Drainage without infection of the general pleural cavity can be

* Read before the American Surgical Society, April 10, 1914

accomplished with certainty only when instituted through adhesions between the parietal and visceral pleura. Nature herself provides these adhesions in approximately 50 per cent of the cases. In cases where such adhesions do not exist, they may be caused by a two-stage operation. The essential factors of this two-stage operation are that at the first stage an ample flap of the chest wall, including the skin, subcutaneous tissues, and muscles, shall be turned back. The ribs are then resected subperiosteally, and the intercostal vessels ligated. Finally the lung is sutured to the parietal pleura around the edges of the area thus exposed, or adhesions may be caused by packing gauze over the surface of the parietal pleura. At the second stage, the skin-muscle flap is again turned back and the abscess opened through the firm adhesions.

If a general anæsthetic is used with any one of the three methods before mentioned, the lung may be distended while these fixation sutures are being placed. If a local anæsthetic is used, the patient can readily expand the lung at the desired time. Of the general anæsthetics, chloroform, ether, and nitrous oxide with oxygen have been successfully used. In the light of clinical experience, however, and with the knowledge of the immediate or late effects of chloroform as shown by the experience of Opie⁵ and others, we can no longer, I think, justify the use of chloroform as a general anæsthetic. The use of ether as routine is probably attended with less danger than that of any other general anæsthetic, but ether has a specifically irritating action upon the respiratory tract. Theoretically, therefore, ether is not an ideal anæsthetic for these cases, though it must be acknowledged that because of the greater familiarity in administering ether, it can probably be used with greater safety in most clinics than nitrous oxide. Nitrous oxide with oxygen would seem to be the ideal general anæsthetic for these cases of lung infection. The mixture itself is not irritating to the respiratory tract. The anæsthesia may be carried out to the satisfaction of the operator, and yet be of so light a degree that the protective reflexes of the trachea are only temporarily abolished. The depressing effect is less marked than with any other general anæsthetic. Any general anæsthetic increases the danger of pulmonary infection, and should be used only in cases in which, on account of the failure to localize the cavity, preliminary exploration of the lung is necessary, or in children who cannot be controlled with a local anæsthetic.

Theoretically, any one of the three methods mentioned for the prevention of the collapse of the lung with the pleural cavity opened may be used. Practically the intratracheal insufflation method is dis-

tinctly superior to the positive and negative pressure methods, because it possesses all the advantages of either and eliminates many of their disadvantages. Further, by the force of the return current of air along the intratracheal tube, the accumulation of foreign material in the trachea is prevented, thereby lessening the danger of further infection in the lung.

With the exceptions noted as applying to abscesses which are impossible of sufficiently definite localization, and in children, local anaesthesia with or without morphia or scopolamine, with some one of the less toxic drugs such as stovaine or novocaine, avoids entirely the dangers of any one of the general anaesthetics. The reflection of the flap and the resection of the ribs can be accomplished without pain and without increasing the difficulties of the operator. In the second stage of the operation, only limited infiltration of the local area through which drainage is to be instituted is necessary, in fact, the opening of the cavity may be accomplished with no anaesthetic other than morphia or scopolamine.

The two cases which I have to report are as follows. They are both from the surgical service of the Washington University Hospital.

CASE I (Hospital No 7873) —White male, broom-maker, age fifty-five. Patient entered the medical service August 11, 1912, and was transferred to the surgical service August 14. The family history was negative, and the patient's history was negative except for persistent cough on account of which he entered the hospital. Nine months before admission, he had a sudden pain in the right side and three days later a cough began, which has persisted. In the past nine months he has lost 51 pounds. The sputum, 300-400 c c in 24 hours, showed pus-cells and mucus, pneumonococci, and streptococci, but no tubercle bacilli, no elastic fibres. Examination of the chest showed the right clavicle to be more prominent than the left. Expansion was better on the right than on the left. Scattered râles were heard on both sides. At the angle of the right scapula, extending backward to the spine, was an area of marked hyper-resonance and below this an area of 5 cm in diameter of moist râles. Surrounding this area of moist râles there was a narrow zone of distinct dulness. The X-ray showed a distinct triangular cavity with heavy walls directly beneath the eighth rib. The heart was normal.

First-stage operation on August 15. Under local anaesthesia, a flap of skin and subcutaneous tissue about 6 by 8 cm was turned back at the angle of the scapula. The eighth and ninth ribs were

exposed over the site of the lesion as shown by the X-ray, and 6 cm of each subperiosteally resected. The intercostal vessels were ligated and the intercostal muscle resected, exposing the parietal pleura. There were no adhesions of the lung over this area. The lung could readily be inflated by the patient and brought in contact with the parietal pleura. Stay sutures of catgut were placed without difficulty, uniting the lung to the edge of the exposed area of pleura. Placing the sutures caused no discomfort. A layer of gauze was then spread over this area and a skin flap loosely approximated with superficial sutures. Six days later, the flap was turned back without an anæsthetic, and, after several exploratory punctures of the aspirating needle, the cavity was found slightly upward and backward from the exposed area of pleura. A grooved director was then inserted and this tract dilated with a clamp. A large amount of foul smelling pus escaped. A rubber drainage tube was then inserted.

Following the operation, large amounts of foul smelling pus and necrotic pieces of lung tissue were discharged daily, but the patient was comfortable and much relieved of his cough. Within two weeks after the operation the amount of discharge began to diminish rapidly, and three weeks after operation he was discharged from the hospital, having gained 26 pounds in weight and rarely coughing up any sputum. In January, 1914, the patient reported that his sinus had closed very soon after leaving the hospital, that he had returned to normal weight, and had been in perfect health since the operation.

CASE II (General Hospital No 9738) —Negro, male, laborer, age thirty-seven. Entered the medical service September 11, 1912, on account of persistent cough and large amount of sputum. He was transferred to the surgical service September 13. Family history negative. Patient's history not remarkable, except for the cough, on account of which he came to the hospital. Fifteen months previous to entrance he had pneumonia. Ever since then had been troubled with a persistent cough. One month after pneumonia, he began to cough up a considerable amount of sputum, and stated that he had coughed up blood. At one time he thought that he had night sweats, but had had none recently. Had lost 32 pounds in weight. Examination showed a markedly emaciated negro. The heart was negative. The chest in front showed marked depressions in the infra- and supraclavicular regions. The breath sounds at both apices were harsh, more marked on the right. Vocal and tactile fremitus was present on both sides. The left back was not remarkable. On the right side extending from the level of the fourth rib down to the tenth rib along the spinal column extending out under the scapula was

an area of diminished resonance There was no "cracked pot" sound Below this area of diminished resonance, there were numerous râles The sputum varied from 450-650 c c per day It was foul smelling, had no elastic fibres, and consisted largely of pus There were no tubercle bacilli, but numerous cocci The X-ray showed the irregular outline of a cavity extending from the fifth rib down to the ninth, with a zone of uninvolved lung between the cavity and the spine

September 16, with morphia and novocaine infiltration, a V-shaped skin and muscle flap with the base toward the spine and extending out over the scapula was turned back The sixth and seventh ribs thus exposed were resected, the scapula being drawn forward The intercostal vessels were tied, and the lung sutured to the parietal pleura There were some adhesions between the parietal and the visceral pleura, but these were not sufficiently dense to warrant opening of the abscess The visceral pleura was then excised, leaving the lung surface exposed One layer of gauze was placed over this exposed area and the flap held loosely with stay sutures The patient was in no way disturbed by the operation A few days later the flap was again elevated, the abscess located with an aspirating needle, and the tract dilated as in the previous operation, a drainage tube being inserted On opening the cavity, a large amount of foul smelling pus was discharged

Four days after the operation, the amount of sputum had decreased by 200 c c Until this time, the post-operative convalescence had been satisfactory Following this, the condition did not improve, the urine showed increased number of pus-cells and some casts Ten days after operation, there was a sharp attack of tonsillitis accompanied by enteritis On the next day there was a severe hemorrhage The dressings were saturated with blood and a considerable amount was expectorated There was another severe hemorrhage the following day, and 13 days after operation the patient died, immediately after the third severe hemorrhage No autopsy was obtained

The only difference in the technic of the two operations was that in the second the parietal pleura was excised This I think offers no advantages, and does add to the difficulties of the operation In the second case, though no tubercle bacilli were found, the history and the X-ray findings are suggestive of a tuberculous process No attempt was made to pack the cavity with gauze, it being thought that in the extreme condition of the patient any interference was contra-indicated

These cases illustrate no new method of operating, and the advan-

tages of local anæsthesia have been fully appreciated by many ⁶ They are reported because too generally surgeons continue at least to complicate, and, I believe, to really increase the dangers of operations for draining abscesses of the lung by failing to recognize the essential factors of the operative procedure Non-tuberculous abscesses of the lung should be treated on the same general surgical principles as any other abscesses, and drainage instituted by such means as to limit, so far as possible, the further spread of the infection, and to conserve the strength of the patient

BIBLIOGRAPHY

- ¹ Sauerbruch, F Cent f Chir, Band xxxi, s 146
- ² Brauer and Peterson Hoppe-Seyler's Zeitschr f physiol Chemie, Band 41, Heft 4
- ³ Meltzer, S J, and Auer, J Jour of Exp Med, vol xi, p 622
- ⁴ Garre and Quincke Lungen Chirurgie, June, 1912
- ⁵ Opie, E L, Barker, B I, and Dochez, A R Jour of Exp Med, vol xiii, p 162
- ⁶ Sauerbruch, F Technik der Thoraxchirurgie

RESULTS OF CONSERVATIVE TREATMENT OF CYSTIC DISEASE OF THE BREAST*

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THE pathological condition which is commonly known in English medical literature as "cystic disease of the breast," and in German publications as "chronic cystic mastitis" (Koenig mastitis chronica cystica) has had many other names applied to it, and many attempts have been made to determine its significance as a precursor of carcinoma. It is a generally accepted fact that a certain percentage of cases of this disease sooner or later show evidence of carcinoma. The percentage of cases in which carcinoma occurs has been estimated by the majority of writers as in the vicinity of 10 (Greenough and Hartwell, Tietze, Warren). These figures, however, have been based upon series of cases of cystic disease in which operation has disclosed the presence of carcinoma. Thus Greenough and Hartwell,¹ in 1903, published 30 cases, in 3 of which carcinoma was present (10 per cent), Warren,² 115 cases of cystic disease of which 15 were carcinoma (13 per cent), Tietze³ estimates 10 per cent. The most recent tabulation is that of Bertel's⁴ 21 cases of which 6 were carcinoma (25 per cent).

The cases here presented give an opportunity for the estimate of the occurrence of carcinoma in this disease from a somewhat different stand-point. Eighty-three cases have been investigated in which cystic disease was present, and proved by pathological examination of the tissue removed at operation, but all were cases in which only a partial removal of the diseased gland tissue was performed. The subsequent incidence of carcinoma in these cases, therefore, gives a further light upon the tendency toward its development in cystic disease of the breast.

* Read before the American Surgical Association, April 11, 1914.

For the purposes of this paper cystic disease of the breast⁵ may be defined as a diffuse process involving a large part, if not the whole, of the breast or of both breasts, and presenting an increase of the interlobular connective tissue and dilatation of the gland ducts into macroscopic or microscopic cysts. Within these cysts the gland epithelium shows a variety of different conditions, of which we distinguish three main classes: (1) the simple fibrocystic type of the disease with flattened or atrophic epithelium, and two types showing epithelial proliferation, (2) papillary epithelial proliferation, and (3) adenomatous epithelial proliferation. It is our belief that the latter class (3) is very near to the line of infiltrating epithelial growth or carcinoma.

We do not include as cases of cystic disease, cases of the type known variously as "papillary cyst adenoma," "villous papilloma," or "duct cancer," in which gross intracystic papillary growths occur, accompanied often by the discharge of blood from the nipple. This condition we have regarded as true local tumor formation, and one which has its own, and indeed a very high, predisposition to carcinoma.⁶

MacCarty,⁷ of the Mayo clinic, has recently described three groups of epithelial growth in cystic disease: (1) frankly benign, (2) doubtful, suggesting the possibility of carcinoma, but without infiltration, and (3) carcinoma. For clinical purposes this classification is simple and comprehensive, but it is our belief that the line between Class 1 and Class 2 will be hard to draw, and that the designation of any lesion as carcinoma, without evidence of infiltration of the stroma with epithelial cells, is a difficult feat for the most expert pathologist to attempt.

The varied character of cystic disease is well shown by the number of different names that have been applied to it. It is certainly true, as recently emphasized by Syms,⁸ that a very careful gross serial section of the breast, with microscopic examination of the more suspicious areas, is necessary for an accurate pathological report upon the tissues removed at operation. Indeed, we have been struck with the fact that changes of the epithelium, quite analogous to those found in cystic disease, occur in other diseases and tumors of the breast—as for instance in periductal fibroma and sarcoma, and in some of the chronic inflammatory conditions following incomplete lactation. From these facts we would conclude that the proliferative epithelial changes which occur in cystic disease are not peculiar to this disease of the breast alone, but are phenomena associated primarily with the epithelium of the tubules and acini of the mammary gland. Under such abnormal conditions as occur in cystic disease, and in some local tumor growths, the

breast, adherent to the chest wall, and with large glandular metastases in the axilla—inoperable carcinoma

CASE XXXI—Came to the hospital in 1898, at 16 years of age, with a cystic hygroma of the left neck and axilla, extending down to the border of the left breast. This was removed. In June, 1904, she presented herself again at the hospital with indurated fibrocystic areas in the left breast and to a less extent in the right also. At this time she was twenty-two years old. Partial plastic resection of the left breast was done. Very little epithelial proliferation was found, but a large amount of fibrous tissue. One year later she came again to the hospital with a large mass occupying the upper half of the left thorax, the axilla, and beneath the clavicle. A specimen of tissue removed for diagnosis showed undoubted adenocarcinoma. No further record of this case is obtainable.

CASE XXXVIII—Female, aged forty-two years, came in for diffuse induration of the left breast, of six months' duration. Plastic resection was done, and the specimen showed marked epithelial proliferation of the papillary and adenomatous types. Six months later discharge from the nipple began again, and four years later another nodule of disease was present in the same breast, but operation was refused. Eight years after the original operation the patient was living, but had carcinoma of both breasts, and both axillæ, with metastases above the clavicle, in the sternum and pleura, and in the spine.

CASE LVI—Female, aged forty-one years, presented a small cystic area of three months' duration. Partial plastic resection was done, and the specimen showed marked epithelial proliferation of the papillary and adenomatous types. The pathologist regarded it as "on the border-line of carcinoma." Three years later the patient showed a nodule on the border of the axilla (an outlying lobule of the upper outer quadrant) which was excised and examined, and found to be adenocarcinoma. A complete operation for carcinoma was then done, but no other evidence of carcinoma was found, either in the breast or the axillary glands. Two years later (January, 1914) the patient showed no evidence of recurrence.

Cases XXXVIII and LVI may be considered the typical history of cystic disease of the advanced proliferative type. Case LVI developed adenocarcinoma after three years, XXXVIII had a return of the cystic disease in four years, and refused operation. After another period of four years she presented evidence of bilateral inoperable cancer. The other cases are less typical—XV developed carcinoma three years after the removal of a cystic area the degree of epithelial activity in this specimen

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could not be determined Case XXXI, that of the cystic hygroma, was an unique case No exidence of proliferative epithelium was present in the cystic area removed at operation One year later, however, she presented an inoperable carcinoma.

Of the 83 cases in this series four patients have died of other causes, without evidence of any disease of the breast

Case XVII, six years after operation of sarcoma of face and mouth

Case XXIV, eight years after operation of heart disease

Case XXVI, nine years after operation of tuberculosis

Case XXXV, eight years after operation of accidental burns

Sixty-two cases are alive and well, and these with the four cases dead without recurrence, make 66 of the 83 cases, or 80 per cent, free from recurrence and apparently up to the present time, at least, cured of their disease by a partial operation The periods for which these 66 cases have been under observation are

Up to 1 year	9 cases
Up to 2 years	6 cases
Up to 3 years	3 cases
Up to 4 years	1 case
Up to 5 years	5 cases
Up to 6 years	9 cases
Up to 7 years	5 cases
Up to 8 years	4 cases
Up to 9 years	3 cases
Up to 10 years	4 cases
Up to 11 years	4 cases
Up to 12 years	3 cases
Up to 13 years	1 case
Up to 14 years	4 cases
Up to 15 years	1 case
Up to 16 years	3 cases
Up to 17 years	1 case
	—
Total	66 cases

A total of 476 years, and an average of 7 2 years each

Thirteen cases (15 6 per cent) showed sooner or later a return of the disease In five cases the disease returned in the other breast, and in eight cases it recurred on the same side, in the gland tissue remaining after the first partial operation One patient died 10 years after operation with a broken hip Another five years after operation with a cerebellar endothelioma In neither case was there evidence of any malignant process in the breast, though both were reported to have had recurrence of cysts Four cases refused operation, and were re-

ported living and well but with cystic disease present—one 1 year, and three 5 years after operation. The other seven were operated upon again, by amputation of both breasts in the greater number of cases, and reported well at intervals of 10, 5, 4, 2, 1½ years 7 months, and 1 month later.

Thus either recurrence of the cystic disease or carcinoma occurred in the breast first subjected to a partial operation in 12 cases out of the 83, or 14 per cent. In 16 cases, or 19 per cent, the patient failed to get permanent relief by the partial operation. In this connection it is of interest to note that in 19 of the 83 cases, or 23 per cent, the disease affected both breasts, although in a different degree. Of the 19, 14 had operative treatment on both breasts, and 5 had operation on one side alone.

A point to be considered in judging the value of the partial operation is the immediate result of operation and the rapidity of convalescence. It must be admitted that an operation which involves the healing of the fibrous tissue of the breast, after it has been united with buried sutures, takes more time and is attended by more sensitiveness than the elliptical amputation with removal of the whole gland. Sepsis is not greatly to be feared in either case unless a suppurative process is present in the ducts, a condition which occurs in a very small percentage of cases. We are in the habit of draining these wounds under any circumstances, because of the difficulty in controlling hemorrhage from the fibrous breast tissue. In spite of drainage, however, annoying hæmatomata have occurred in a few cases, and have required evacuation.

In favor of the partial operation can be adduced the strong sentimental feeling shown by women against the mutilation of an amputation. It has been said that consent to operative investigation of a breast tumor can more readily be obtained if the prospect is offered to the patient that she may not have to undergo the amputation. In our experience, however, the awakening public interest in cancer, and the more wide-spread knowledge of that disease, has provided a material argument in favor of radical operation, and few cases will be deterred on this account from accepting the best advised surgical relief at the present day.

In Dr Warren's original description of the operation of plastic resection, the point was made that either one entire quadrant or the whole of the gland tissue could be removed by this method. The æsthetic result is less satisfactory when the whole gland is removed, as there is not sufficient tissue available to make up the rounded con-

figuration of the breast to its former degree of prominence. The scars, however, are distinctly less disfiguring after this operation than when elliptical amputation is done and the nipple removed. The complete removal of the gland tissue by the plastic resection incision we have called "subcutaneous amputation." It is a fact that in this series in not one of the 23 cases in which Dr. Warren himself performed the partial operation has recurrence taken place on the affected side. This is perhaps due to the discrimination used in applying the operation only to the less advanced and therefore more suitable cases of the disease. For such early and favorable cases the operation is to be preferred to local excision with its more evident and disfiguring scars.

For more advanced cases of cystic disease, either the subcutaneous amputation or a total amputation is to be preferred. Where considerable doubt exists as to the diagnosis between cystic disease and carcinoma, total amputation will be the operation of choice, as there is little doubt that the subcutaneous amputation in cancer cases would invite recurrence of the disease.

In our experience exploratory removal of a nodule, suspected of being carcinoma, from the breast by local excision is a very dangerous procedure. We do not do this ourselves, but we have had a number of cases referred to us where such a local excision has been done by another surgeon, and we found that recurrence was almost inevitable, even when the local excision has been followed almost immediately by the most extensive and complete operation for cancer.

The safest way of exploring a breast tumor of doubtful diagnosis we believe to be by the removal of the entire breast, with the pectoral fascia, by elliptical amputation. The breast is then sectioned and frozen sections are made if necessary. If carcinoma is found the complete operation is performed. This procedure depends for its safety upon the fact that doubtful cases of cancer are early cases, and that in early cases extension beyond the confines of the breast itself may reasonably be expected not to have occurred.

CONCLUSIONS

1. Of 83 cases of partial operation for cystic disease of the breast, 17, or 20 per cent, were unsuccessful.

2. In 4 cases carcinoma occurred in the breast tissue left by the partial operation—4.8 per cent.

3. In 5 cases the disease recurred only in the other breast—5.9 per cent.

4 In 8 cases the disease returned in the breast tissue left by the first partial operation—9.6 per cent

5 The occurrence of carcinoma in cases of cystic disease, estimated at about 10 per cent of all cases, demands radical treatment in all but the mildest cases

6 The operation of choice should remove all of the gland tissue of the affected side, and, when the disease is bilateral, of both sides

7 This can best be accomplished by "subcutaneous amputation," leaving the nipple and areola, or by elliptical amputation

8 Where grave doubt as to diagnosis is present elliptical amputation is to be preferred

9 Local excision of nodules in the breast, suspected of being malignant, should never be performed

10 The operation of local excision or partial plastic resection should be restricted to the earliest and mildest types of cystic disease In such cases plastic resection is the operation to be preferred

ABSTRACT OF CASES

CASE 1 (Dr John Homans)—Aged forty-one, married Masses in both breasts of two years' duration Slight pain Operation plastic resection, both breasts Recurrence in one breast Patient died 10 years later with broken hip.

CASE 2 (Dr C B Porter)—Aged fifty-nine, married Duration 1½ years Tumor size of orange, left breast Operation excision Well 17 years later.

CASE 3 (Dr M H Richardson)—Aged forty-nine, widow, no children Duration 1½ years Painful mass, size of an egg, in right breast Operation excision Well 16 years later

CASE 4 (Dr F B Harrington)—Aged forty, married Duration 3 months Tumor size of a lemon Operation plastic resection Well 16 years later

CASE 5 (Dr C B Porter)—Aged thirty-eight, single Duration 4 months. Tumor size of an egg, outer half of left breast Operation excision Well 15 years later

CASE 6 (Dr A I Cabot)—Aged forty-nine, single Duration 3 months Mass size of an egg in each breast Operation excision Recurred 4 years later in the left breast Recurrence excised Well 11 years later

CASE 7 (Dr J C Warren)—Aged forty-eight, married, 3 children Duration 6 months Tumor size of an egg, outer lower quadrant left breast Operation plastic resection Well 14 years later

CASE 8 (Dr A T Cabot)—Aged thirty-six, single Duration several years Slight pain with periods Mass size of an egg, outer upper quadrant left breast Operation plastic resection Well 15 years later

CASE 9 (Dr J C Warren)—Aged forty-one, single Tumor size of walnut, outer lower quadrant right breast, which varies in size and is slightly painful Operation plastic resection Well 14 years later

CASE 10 (Dr A T Cabot)—Aged forty-three, single Duration 2 months Slight pain Tumor upper half right breast, size of a walnut Operation excision Well 14 years later

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CASE 11 (Dr S J Mixter) —Aged forty-nine, married Duration 8 months Painful tumor, inner half of left breast, the size of a walnut Operation. excision Well 14 years later

CASE 12 (Dr A T Cabot) —Aged forty-nine, single Mass in the lower half of left breast Slightly painful with periods Operation excision Well 13 years later

CASE 13 (Dr F B Harrington) —Aged forty-seven, married, 1 child Duration 9 months Slightly painful Mass in the outer lower quadrant of both breasts, size of walnut Operation excision Well 12 years later

CASE 14 (Dr F B Harrington) —Aged forty-nine, married Duration 1½ years No pain Tumor size of egg in breast Operation plastic resection Well 12 years later

CASE 15 (Dr W M Conant) —Aged thirty-three, single Duration 1 year Mass the size of one-half lemon, in the lower half of left breast Slightly painful, and yellowish discharge from the nipple at times Operation. excision Three years later reported ulcerated tumor of the breast, metastases in the axilla Diagnosed as inoperable carcinoma

CASE 16 (Dr J C Warren) —Aged forty-three, married, 5 children Duration 2 months Mass size of egg in the outer lower quadrant right breast Operation plastic resection Eight years later reported with cysts in the other breast, but no operation was performed Well 12 years after the operation

CASE 17 (Dr H H A Beach) —Aged forty-seven, single Duration 8 months Bloody discharge from the nipple at times, and breasts somewhat painful Tumor in the outer upper quadrant left breast, and similar tumor in the right breast Excision of mass of left breast, and amputation of right breast Died of sarcoma of the mouth 6 years later

CASE 18 (Dr J C Warren) —Aged thirty-seven, married, no children Duration 5 months Some change in size with periods Diffuse masses in both breasts Operation plastic resection Well 12 years later

CASE 19 (Dr J W Elliot) —Aged thirty-two, single Duration 6 weeks, no pain Mass the size of egg, upper outer quadrant left breast Operation excision Well 11 years later

CASE 20 (Dr M H Richardson) —Aged fifty-four, married Duration 2 weeks A slightly painful tumor, size of walnut, upper outer quadrant, right breast Operation excision. Well 12 years later

CASE 21 (Dr J W Elliot) —Aged forty-six, married, 3 children Duration 2 weeks Small tumor in lower outer quadrant, right breast, not painful Operation excision Well 11 years later

CASE 22 (Dr R B Greenough) —Aged twenty-two, single Two slightly painful tumors in outer half right breast, size of walnuts Pain somewhat worse with periods Operation plastic resection Well 2 years later

CASE 23 (Dr J C Warren) —Aged forty-two single Duration 4 months Two slightly painful tumors in each breast, size horse chestnut Operation plastic resection, both breasts Well 10 years later

CASE 24 (Dr W M Conant) —Aged thirty-five, widow, no children Duration 2 months Tumor size of horse chestnut in lower outer quadrant of left breast, not painful, but varying somewhat in size Operation excision Died 8 years later with heart trouble No recurrence

CASE 25 (Dr W M Conant) —Aged forty-two, married, 3 children Dura-

tion 2 months Tumor in upper outer quadrant right breast, size of lemon, not painful Operation excision. Well 10 years later

CASE 26 (Dr J C Warren)—Aged forty-one, married, 3 children. Diffuse masses in both breasts, not tender, some discharge from nipple. Operation plastic resection, both breasts Well 9 years later

CASE 27 (Dr J C Warren)—Aged forty-seven, married Duration 2½ months Slightly painful tumor in upper inner quadrant right breast. Operation plastic resection One year later patient had small tumor in the other breast No operation was performed

CASE 28 (Dr J C Warren)—Aged fifty, married Duration 4 months Slightly painful tumor in the lower half of right breast Operation plastic resection Well 10 years later

CASE 29 (Dr W M Conant)—Aged forty-three, single Duration 5 months A slightly painful tumor in the upper inner quadrant of right breast, size of lemon Operation excision Well 9 years later

CASE 30 (Dr J W Elliot)—Aged forty-six, married, 6 children Duration 3 weeks Slightly painful diffuse mass occupying a large part of left breast Operation excision One year later patient entered the hospital with recurrence in other breast There were 2 small tumors in the outer hemisphere of the left breast These were excised No recurrence in either breast 5 years later

CASE 31 (Dr W M Conant)—Aged twenty-two, married Six years previously (at age of sixteen) operation for "cystic hygroma" of left neck, axilla, and breast Duration 1 month Diffuse masses in both breasts, no pain Operation plastic resection of left breast, right not operated upon One year later patient reported with an ulcerated tumor of the left breast, and palpable glands in the axilla Pathological examination of specimen removed showed adenocarcinoma The condition was deemed inoperable

CASE 32 (Dr J C Warren)—Aged forty-eight, single Duration 3 months A tumor size of egg in upper inner quadrant left breast, not painful Operation plastic resection Well 10 years later

CASE 33 (Dr J C Warren)—Aged thirty-six, single Duration 1 week A slightly painful tumor in the upper outer quadrant of left breast, size of a plum Operation plastic resection No recurrence in this breast 10 years later, but 2 masses the size of an almond in the other breast

CASE 34 (Dr J C Warren)—Aged thirty, single Duration 5 days A slightly painful tumor in the lower outer quadrant of right breast Operation plastic resection Well 3 years later

CASE 35 (Dr M H Richardson)—Aged thirty-two, married, 4 children A mass the size of a small egg in the outer half of the left breast Breast painful during the catamenia Operation excision Well 8 years later

CASE 36 (Dr J C Warren)—Aged thirty-five, single Duration 1½ months Tumor in the upper inner quadrant of right breast, varied somewhat in size, but was not painful Clear discharge from the nipple at times Operation plastic resection Well 8 years later

CASE 37 (Dr D F Jones)—Aged forty-four, married, 2 children Duration 1 week Tumor size of an egg in the upper outer quadrant of right breast Operation plastic resection Well 8 years later.

CASE 38 (Dr D F Jones)—Aged forty-two, married, 3 children Dura-

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tion 6 months Diffuse mass occupying large part of the left breast, slightly painful, and with a serous discharge from the nipple at times Operation plastic resection Six months later patient reported with a continuation of the discharge from the nipple, but refused operation Four years later recurrence of cysts in left breast Eight years after operation patient died with carcinoma of both breasts, and metastases in the axillæ, spine, etc

CASE 39 (Dr C A Porter) —Aged forty-nine, widow, no children Tumor size of an almond in outer half of left breast. Operation excision Well 7 years later

CASE 40 (Dr J C Warren) —Aged forty-three, single Duration 3 years Slightly painful tumor in the inner half of right breast which varies somewhat in size. Operation plastic resection Well 6 years later

CASE 41 (Dr. J C Warren) —Aged twenty-seven, single Tumor in the upper outer quadrant of right breast Slight pain which was increased during catamenia Tumor also varies in size with periods Operation plastic resection Well 6 years later

CASE 42 (Dr R B Greenough) —Aged forty-eight, married Duration 2 years Tumor the size of walnut in the inner lower quadrant of right breast. Discharge from the nipple Operation plastic resection Well 7 years later

CASE 43 (Dr Hugh Williams) —Aged forty-two, single Duration 3 weeks Painful tumor size of walnut in upper outer quadrant left breast Operation excision Well 7 years later

CASE 44 (Dr J C Warren) —Aged forty-seven, married, 1 child Duration 10 days A mass the size of an egg in the outer half of right breast, not painful Operation plastic resection Well 7 years later

CASE 45 (Dr J C Warren) —Aged forty-five, married, no children Duration 6 months A painful indefinite mass in the outer half of left breast Operation plastic resection Well 2 years later, but occasionally has slight neuralgic pain in breast

CASE 46 (Dr J C Warren) —Aged forty-three, married, 2 children Duration 3½ years Two masses, size of an egg, in upper outer quadrant right breast Operation plastic resection Well 6 years later

CASE 47 (Dr F G Balch) —Aged seventy, married Duration 1 month. Tumor size of plum, inner lower quadrant left breast Operation excision Well 6 years later

CASE 48 (Dr J C Warren) —Aged forty-three, married Duration 4 months Small tumor inner lower quadrant left breast, painful at time of periods. Operation plastic resection Well 6 years later

CASE 49 (Dr J C Warren) —Aged forty-six, single Duration 2 weeks Painful tumor inner half of left breast Operation plastic resection Well 6 years later

CASE 50 (Dr J C Warren) —Aged forty-nine, married, several children Small mass upper outer quadrant left breast Operation plastic resection Well 6 years later

CASE 51 (Dr C L Scudder) —Aged forty-three, single Duration 1 year A painful mass upper outer quadrant left breast Operation: excision Five years later patient reported that a small tumor had recurred in the left breast.

CASE 52 (Dr C L Scudder) —Aged twenty-four married, 1 child Tumor

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in upper outer quadrant left breast Operation plastic resection Well 5 years later

CASE 53 (Dr F G Balch) —Aged forty-five, widow Duration 10 years Mass the size of an egg in the upper portion of each breast Operation excision Well 5 years later

CASE 54 (Dr C A Porter) —Aged twenty-four, married Duration 1 year Small tumor in the upper outer quadrant left breast Painful at time of periods Operation plastic resection Well 5 years later

CASE 55 (Dr J C Warren) —Aged forty-three, single Duration few days Mass the size of walnut outer portion of right breast, not painful Operation plastic resection Well 5 years later

CASE 56 (Dr R B Greenough) —Aged forty-one, married, 4 children Duration 3 months A non-painful mass, lower outer quadrant right breast, size of a pea Operation plastic resection Four years later patient returned with a palpable nodule in the axillary border, which on removal proved to be carcinoma A complete operation was done, with removal of breast, both pectoral muscles, and axillary contents Well 2 years later

CASE 57 (Dr F G Balch) —Aged forty-six, married, 8 children Duration 2 months Mass size of an egg in the upper outer quadrant of left breast Operation excision Well 4 years later

CASE 58 (Dr C C Simmons) —Aged thirty-nine, single Duration 3 months Tumor size of a bean upper outer quadrant of right breast Operation plastic resection Well 5 years later

CASE 59 (Dr C C Simmons) —Aged forty, widow Duration 2 weeks Two small, slightly painful masses in the outer half of right breast Operation plastic resection Well 2 years later

CASE 60 (Dr R B Greenough) —Aged forty-one, single Duration, in the right breast 8 years, in the left 2 years Diffuse masses in both breasts, the larger being in the upper outer quadrant of right These changed in size with periods, but were not painful Right breast had local excision in California 8 years before, and recurred 10 years later Operation plastic resection, left breast Well 4 years later

CASE 61 (Dr Hugh Williams) —Aged forty-four, married, 1 child Duration 4 years Small painful tumor in upper outer quadrant left breast Operation plastic resection Well 3 years later

CASE 62 (Dr R B Greenough) —Aged forty-nine, married, 1 miscarriage Duration 2 years Mass size of an apple in upper outer quadrant of right breast, painful at time of periods Operation plastic resection Well 3 years later

CASE 63 (Dr J G Mumford) —Aged fifty, married, 1 child Duration 4 months Tumor size of an egg occupying centre of left breast Operation plastic resection Well 2 years later

CASE 64 (Dr C C Simmons) —Aged forty-seven, married, 8 children Duration 3 months Painful tumor, size of filbert, upper inner quadrant right breast Operation plastic resection Well 1 year later

CASE 65 (Dr C C Simmons) —Aged forty-four, married, no children Duration 6 weeks Slightly painful mass in lower inner quadrant left breast Operation plastic resection Well 2 years later

CASE 66 (Dr R B Greenough) —Aged thirty-four, married, no children Duration 3 months Slightly painful mass in upper outer quadrant left breast,

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size of walnut Operation plastic resection Two years later patient reported with a cyst in the upper outer quadrant of the other breast, which was excised The right breast at this time showed no recurrence

CASE 67 (Dr R B Greenough) —Aged forty-seven, married, 2 children Duration 1 year Painful tumor, size of a walnut, upper inner quadrant left breast Operation plastic resection Well 1 year later

CASE 68 (Dr R B Greenough) —Aged forty, single Duration 6 months Small tumor in upper outer quadrant left breast, which is slightly painful Operation excision One and one-half years later several indefinite masses had recurred in the right breast, and also in the left. Subcutaneous amputation of both breasts was done Patient well 1 year later

CASE 69 (Dr R B Greenough) —Aged forty, married Duration 1 year Tumor in upper outer quadrant left breast, size of an egg, slightly painful Operation plastic resection Seven months later mass recurred with diffuse fibrous thickening Amputation performed Well 7 months later

CASE 70 (Dr C C Simmons) —Aged thirty-two married, 2 children Duration 3 months Slightly painful tumor in upper outer quadrant left breast, size of walnut, this varied somewhat in size Operation plastic resection Well 2 years later

CASE 71 (Dr R B Greenough) —Aged thirty-nine, married An indefinite thickening of upper outer quadrant right breast, slightly painful during periods Duration 2 years Operation plastic resection Well 10 months later

CASE 72 (Dr R B Greenough) —Aged thirty-six, married, several children Tumor, size of walnut, upper outer quadrant right breast, which was slightly painful and which varied in size somewhat Operation plastic resection Well 10 months later

CASE 73 (Dr R B Greenough) —Aged twenty-nine, single Duration 4 years Many diffuse masses in both breasts, varying in size up to a walnut which were slightly painful at time of periods Operation plastic resection of the right breast, excision of mass in left breast Ten months later slight recurrence felt in both breasts

CASE 74 (Dr R B Greenough) —Aged thirty-five, single Duration 2 weeks Slightly painful mass, size of an egg, occupying centre of right breast, and a small one in upper outer quadrant of left breast Operation plastic resection of right breast Seven months later right breast was normal, but the left showed several indefinite cystic masses

CASE 75 (Dr C C Simmons) —Aged thirty-seven, married, 2 children Slightly painful tumor, 1½ inches in diameter, outer lower quadrant left breast Operation plastic resection Six months later no recurrence, but patient complained of neuralgic pain

CASE 76 (Dr C C Simmons) —Aged forty-two, married, 1 child Duration 1 month Painful tumor, size of an egg upper outer quadrant left breast Operation plastic resection Well 5 months later

CASE 77 (Dr J C Warren) —Aged forty-six married, 1 child Duration 2 days Tumor 2 inches in diameter in lower portion of right breast. Operation plastic resection Well 11 years later

CASE 78 (Dr Hugh Cabot) —Aged forty-nine, widow, 2 children Duration 6 weeks Slightly painful tumor occupying centre of left breast 2 inches in diameter Operation plastic resection Well 6 years later

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CASE 79 (Dr F G Balch) —Aged forty-six, married Duration 8 months Multiple cystic masses felt in both breasts, larger in the left, however, than the right Some discharge from the nipple Operation on left breast subcutaneous amputation, on right, excision Well 7 years later

CASE 80 (Dr R B Greenough) —Aged forty-seven, single Duration 2 weeks Diffuse painful masses in both breasts Operation plastic resection of both breasts Patient died 5 years later with endothelioma of brain (autopsy), at that time was reported to have had recurrence in right breast, none in left

CASE 81 (Dr R B Greenough) —Aged thirty-four, single Duration 3 weeks Painful tumor size of an egg in upper outer quadrant right breast, palpable cysts in left Operation plastic resection of right breast Six months later reported with recurrence in right breast Both breasts were then amputated

CASE 82 (Dr E A Codman) —Aged fifty, widow, 5 children Duration 2 years Multiple small cystic tumors, palpable in both breasts, somewhat painful Operation on right breast amputation, left breast, excision of one-half Well 13 months later

CASE 83 (Dr C L Scudder) —Aged forty, married, 4 children Duration 6 weeks Painful tumor, 1 inch in diameter, occupying centre of left breast Operation plastic resection Well 10½ years later

REFERENCES

- ¹ Greenough and Hartwell Jour Med Research, 1903, June, vol 1x
- ² Warren Amer Jour Med Sciences, April, 1907
- ³ Tietze Deut Zeitschrift fur Chirurgie, 1900, lvi, p 512
- ⁴ Bertel Deut Zeitschrift fur Chirurgie, 1913, vol cxxiv, p 1
- ⁵ Greenough and Hartwell Jour Med Research, 1903, June, vol 1x
- ⁶ Greenough and Simmons Papillary Cyst Adenomata of the Breast ANNALS OF SURGERY, February, 1907
- ⁷ McCarthy Surgery, Gynæcology and Obstetrics, vol xvii, March, 1914
- ⁸ Syms ANNALS OF SURGERY, 1913, vol lviii, p 395
- ⁹ Warren Amer Jour Med Sciences, April, 1907

THE TWO-STAGE OPERATION ESPECIALLY IN ITS RELATION TO TREATMENT OF CANCER *

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BOTH the immediate and the remote results of certain operations are improved if these operations be performed in two stages, partly because the patients may be too much weakened to endure at one blow the stress of the entire operation and the subsequent physiological adjustment, partly because one stage may prepare the way for a safer second stage, and in malignant cases that the immediate reimplantation of cancer cells may be prevented. This paper considers cases in the latter class and deals especially with operations for cancer of the rectum, of the stomach, of the large intestine, of the uterus, of the larynx, and of the tongue, with a short discussion also of the value of the two-stage operation in abdominal infections and in exophthalmic goitre.

It is obvious that not all of the foregoing operations should be performed in two stages, but *those only in which a two-stage operation would lessen the risk*. The objection to the two-stage operation in the past has been the reluctance of the patient to endure the ether distress a second time, but if the operation be performed under anociation, with nitrous-oxide-oxygen anæsthesia, then the experience of the *anociated* patient in the first stage of the operation is so much easier than his anticipations—his loss of vitality and change of nervous threshold are so slight—that he is emboldened to meet the second stage with equanimity. It has been gratifying to find that the second—usually the major stage—causes no more disturbance, sometimes less even, than followed the preliminary operation. For example, it has been our experience that in the first of the two stages of a laryngectomy the variations of pulse and temperature were more marked than in the second stage.

Cancer of the Rectum—In cancer of the rectum, the preliminary colostomy prepares the way splendidly for the major operation. In this operation the energy of the patient is so conserved, and he passes through the first stage so easily, that he undergoes the second stage

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without reluctance, while the establishment of the artificial anus in advance of the major dissection makes possible the maintenance of a far less infected wound

Lilienthal and others have heretofore shown the advantages of the two-stage operation in these cases, and since adopting this plan, my associate, Dr Lower, and I have performed sixteen operations for rectal cancer without a fatality

Cancer of the Stomach—In cancer of the stomach, gastro-enterostomy is performed at the first operation, the resection being performed as soon as the nutritional balance is assured—usually within ten days or two weeks. In starved cases of gastric ulcer Professor von Eiselsberg's method is excellent. A jejunostomy is first performed under local anæsthesia, the final operation being delayed until a safe margin of vitality has been attained by feeding. Incidentally, the prolonged gastric rest may cure the ulcer. Gastro-enterostomy alone gives a rather light morbidity as compared to gastrectomy, as in the former the wound is not as extensive as in the latter operation, and the physiologic and anatomic readjustment is more readily made. This readjustment being accomplished, the gastric resection is performed with a wider margin of safety. By dividing the trauma and relieving the patient from the burden of extensive wound recovery simultaneous with the physiologic adjustment, the risk is decidedly less than if one massive chance had been taken.

An unexpected advantage in the two-stage operation for gastrectomy is illustrated by a recent case. A large pyloric mass was diagnosed as cancer and at the preliminary operation even was believed to be cancer. At the second operation, which, on account of the extreme emaciation and weakness of the patient, was delayed for three weeks, it was found that the large solid mass at the pylorus had disappeared as if by magic. To make certain that no cancer existed at its base, the former ulcer was resected—a simple, almost a minor operation. No histologic evidence of cancer was found. Had the entire operation been performed at one time, not only would a needlessly extensive operation have been performed but the patient's life would have been seriously jeopardized.

Cancer of the Uterus—In a dissection operation the greatest danger is that of immediate reimplantation of cancer cells in the operative field. Hence, if the operation is to be performed by the cutting method, extensive destruction by the cautery is a safe preventive of reimplantation.

In *cancer of the cervix*, at the first operation every vestige of the

growth is destroyed by heavy cautery irons which carry enough heat to make a penetrating coagulation of protoplasm—*coagulation not eschar* is the aim. After the local cancerous growth is destroyed the vaginocervical attachments are severed with a dissecting cautery, in order that all blood-vessels running from the vagina to the uterus may be divided. The resultant anæmia will destroy all the detached cancer cells within one day, after which abdominal hysterectomy is performed—without danger of immediate cancer implantation.

In this, as in all two-stage operations, the use of nitrous-oxide-oxygen plays a most benevolent rôle. The patient has no distressing experience in going under this anæsthetic and therefore anticipates the larger operation without fear.

Cancer of the Larynx—At the first stage the deep planes of the neck on each side of the trachea are packed with iodoform gauze. This causes a local reaction which fixes the trachea, and protects the mediastinum. This technic eliminates the great danger of mediastinal infection which, after pneumonia, has caused the greatest number of deaths.

The danger of vagitis also may be eliminated if the dissection is carried on one side of the larynx all the way to the upper margin of the field of final operation, this territory being packed with iodoform gauze just as the deep planes of the neck are packed. By this procedure one vagus must take the brunt of exposure and adjustment before the larynx is removed. By the time the laryngectomy is done this vagus will be readjusted and ready to resume its function.

The second stage—the excision of the larynx—is safely and easily accomplished. Among thirty-four laryngectomies twenty-eight have been performed in two stages with but a single death.

Cancer of the Tongue—In operations for cancer of the tongue two difficult problems must be met, the immediate surgical risk and the possibility of permanent cure. The principal immediate danger is pneumonia from inhalation of infection from the field of operation, while there is also danger from the exhaustion which is a result of the diminished ingestion of food and the prolonged endurance of the disease.

To ensure a permanent cure not only is the cancer to be removed but all of the glands of the neck must be completely excised whether they be enlarged or not. If both of these operations be performed at the same seance, then the patient may go to the ground because he is unable to bear the burden of the diminished nutrition, the soreness over so large a field as the mouth and neck, and the inevitable infection in the mouth. The possibility of a permanent cure depends also on the

prevention of the immediate reimplantation of cancer cells in the mouth at the time of the operation. If the cancer is not large, no cutting operation whatever is made, but with the cautery all of the disease in the mouth is destroyed. If, however, the growth be extensive, it is best on one day to cauterize the field of the disease and on the following day, after the diseased cells have died of starvation, to excise the entire cancer field in the mouth. After the patient has well recovered from the mouth operation and is able to take nourishment satisfactorily, the final operation—the excision of the glands of the neck—can be performed without great inconvenience to the patient.

In addition to the lessened risk of the extension of the cancer, the two-stage operation lessens the danger of infection of the neck field also, for when the whole operation is performed at one seance the neck is so sore that the patient is almost certain to inhale more infection from the mouth directly, whereas if the neck be normal, the patient is able to stand up, to move about, to spit out the inhalations, and thus to better protect the lungs against infection.

Acute Abdominal Infections—In cases of *acute pelvic abscess* resulting from a specific infection, a vaginal puncture, followed by partial resolution, with an abatement of the acute symptoms, leaves an immensely improved risk for a second operation should it be required by a remaining chronic salpingitis.

In *acute appendicitis with a strongly walled off abscess* the appendix is removed if it can be readily picked up, if not, a simple drainage is first made, the appendix being removed after the wound is entirely healed. The cautious entry and the opportune exit under anociation and nitrous-oxide-oxygen anæsthesia leave the patient's phagocytic defenses normally active instead of *anæsthetized by the lipid-solvent ether*. Operation is always on admission. We are able to show a series of 257 operations for acute appendicitis performed under anociation with but two deaths, the average change of pulse during the operation being a fall of 28 beats.

In *critical cases of acute cholecystitis* a similar program is followed. Unless an easy total excision is possible, a simple drainage only is first made—stones are not even searched for. The cholecystectomy is deferred until the acute storm has passed and the margin of safety has been established.

In *obstruction of the bowels from cancer* a feather-edge colostomy serves as a safety valve until the margin of safety has widened, when the excision is performed.

In *gangrene of the intestine with heavy intoxication* the gangrenous

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loop is carried outside the body and drained. If and when a margin of safety is gained an anastomosis is made.

Exophthalmic Goitre—In exophthalmic goitre a two- or even a three-stage operation may play the patient's game more safely. The first operation is the most dangerous, but since hyperthyroidism can be controlled through anociation and morphinization, we now have to fear *acidosis* only. Acidosis may be precipitated by psychic excitation, by physical injury, or by a too sudden diminution of thyroid tissue. For this reason I now perform the preliminary ligation in bed under complete anociation. This we can now do in most cases without causing more reaction than is caused by the excitement of entering the hospital. In some cases there is less reaction in the patient than in the patient's relatives. In a series of exophthalmic goitre cases operated upon under anociation the pulse rate was especially recorded and the average change during the operation was a *fall* of 55 beats.

SUMMARY

- 1 The newer developments in surgical technic, by which much of the danger and most of the suffering and discomfort of surgical operations have been eliminated, have enabled the surgeon to fully utilize the advantages of two-stage operations for cases heavily handicapped by lowered vitality, while in cancer cases the danger of immediate re-implantation is minimized.

- 2 Critical cases of acute infections of the pelvis, of the appendix, or of the gall-bladder, may be more safely treated by a preliminary drainage, the operation being completed after the margin of safety has widened.

- 3 Anociation greatly expands the strategic possibilities of opportune surgery and lessens the mortality and morbidity attending critical operations upon heavily handicapped patients.

- 4 We confidently expect to see the present mortality in stomach and intestinal resections reduced at least one-half by the two-stage operation under the technic of anociation.

ARTERIOVENOUS ANASTOMOSIS OF THE FEMORAL VESSELS FOR IMPENDING GANGRENE

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THE employment of arteriovenous anastomosis as a clinical procedure has given varying results in the hands of different operators, and has led to a considerable difference of opinion on the part of these various operators as to the possibility of establishing a reversal of the circulation. In order to throw some light on the subject, we have attempted the procedure in fifteen cases. We believe that this is the largest series of cases yet reported from a single source.

Halsted and Vaughan, in *Surgery, Gynecology and Obstetrics*, January, 1912, have compiled a history of the cases of arteriovenous anastomosis, and a report of all the cases found in the literature up to that time. They recall that Francois-Frank, in 1881, made the first attempts along this line and that since that time many efforts have been made to produce a satisfactory arteriovenous anastomosis in animals, but success did not result until 1902 when Carrel perfected the technic of vascular experimental surgery and made the first successful anastomosis. He reported two successful end-to-end anastomoses of the jugular and carotid performed on dogs. In 1905, Carrel and Guthrie reported a series of thirteen arteriovenous anastomoses in dogs without a single failure. It is Carrel's work more than that of any other that has led the surgeon to employ this procedure on the human being. Stich, Tuffier and Frouin, Watts, Cottard, and Leriche have since reported a number of successful cases of arteriovenous anastomosis in animals. The result of these experiments is that up to the present time there has been no means proposed of breaking down the resistance of the venous valves to the backward flow of the blood except by the action of the arterial current itself. It is still a matter of doubt how much of the reversed current reaches the periphery and how much is short circuited. It is not known for certain after anastomosis of the femoral vessels whether the femoral vein or its branches will carry backward to the capillaries sufficient blood to maintain unaided by the collateral arteries, the circulation in the periphery of the limb. During the past year C W Allen, of New Orleans, in a study of surgical occlusion found as a result of 168 experiments on

dogs that vessels might be occluded to the point of obliteration, obliterating the pulse for three or four days, before an obliterative endarteritis occurs. All vessels stood compression for 72 hours without recognizable gross visible changes, some showed decided changes in 96 hours. Sheet iron aluminum bands were to be preferred, but ligatures should be condemned.

The first attempt to perform arteriovenous anastomosis in man was made by San Martín y Satrustegui, a Spanish surgeon who reported two cases in 1902 prior to Carrel's successful reversion of the circulation in the carotid artery and the jugular vein. Both of these cases were unsuccessful.

Bertram M. Bernheim, of Johns Hopkins University, in the *ANNALS OF SURGERY*, February, 1912, reports six cases, four of which were successful, and finds at that time that 52 cases have been reported in which arteriovenous anastomosis was performed. A study of these cases shows that 38 were done on males, 10 on females, and in four no sex was stated. The ages varied all the way from 20 to 80 years. Out of these 52 cases there were 15 that may be considered successful, that is, cases in which the reversal, as far as could be judged, actually saved the limb from real or threatened gangrene. Among the failures there were 15 deaths, two from shock, and 13 from senility and erysipelas. Most of these patients were in a desperate condition at the time of operation, and it is improbable that this operation contributed more to the cause of death than any other operation on a limb would have done. In the remaining 22 cases, the course of the disease was uninfluenced by the reversal, although there was a temporary improvement in several instances. Amputation was performed in each instance. The operation was done twice in the upper extremity, once for thrombus and threatened gangrene, and once for threatened gangrene, both times successfully. The remaining cases were in the leg, the operation being performed four times for Raynaud's disease, once for rupture of the popliteal artery and vein, once for sarcoma of the popliteal space, once for aneurism, once for gunshot wound, and in the remainder of the cases for real or threatened gangrene.

As to the methods of operation, end-to-end suture, according to the method of Carrel, was done 23 times with eight successes, lateral anastomosis 12 times with four successes, invagination (end of artery into end of vein) twice with one success, and intubation according to the method of Wieting 9 times with two successes. The method was not

stated in two instances though one of these cases was reported as successful

Dr Bernheim brings out the point in his paper that these 52 operations were done by 32 men, a fact which may account for a number of the failures, since vascular surgery is yet in its infancy and offers many technical difficulties. Another point brought out was that most of the cases in which the operation was performed for gangrene or threatened gangrene had been seen so late in the course of the disease that a blood-vessel operation had very little prospect of meeting with success.

Since the appearance of these articles, Dr Bernheim has reported two cases operated on for Raynaud's disease, one of which was a failure and the other apparently successful. J M Glasstein has reported a successful case (*Revue de Chirurgie*, Paris, April, xxxii, No 4, p 535) and Grieffenhagen (*St Petersburg Medical Wochenschr*) a case in which anastomosis was done between the brachial artery and vein which seemed normal, but on the third day the circulation became defective because of errors in technic and amputation was resorted to. Luxembourg (*Deutsche Zeitschrift f Chirurgie*, Leipzig, April, cxiv, Nos 4 and 5) reports an instance in which he did an arteriovenous anastomosis between the femoral artery and vein with a good result at first but sepsis developed at the end of two weeks which proved fatal. Davies, of London, recently reported a successful case.

The difference in the results of arteriovenous anastomosis obtained by these different operators has led to considerable controversy. Professor Coenen, of Breslau, and Wiewirowski have set forth a great array of experimental work denying the possibility of the complete reversal of the circulation in a limb or the possibility of resuscitating an extremity threatened with gangrene by arteriovenous anastomosis. In a more recent paper Coenen shows the great difficulty of a retrograde flow of blood in the veins and in the discussion which followed the reading of his paper most of the surgeons took his side in decrying the practicability of this operation for gangrene. Bier and Schmieden, of Berlin, were the only ones to express opinions favorable, though guardedly so. Save for four cases which Wieting calls successes, though three of them required amputation sooner or later, all of the other 16 cases brought forward on that occasion were failures.

Halsted and Vaughan after their careful review of the cases reported in the literature and from their experiences with Halsted's own cases, state that their final conclusion is that there is but one indication for the application of

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arteriovenous anastomosis in surgery - namely, in traumatic destruction of a peripheral artery where end-to-end union of the torn vessel is impossible. In such a case arteriovenous anastomosis might be attempted and through it a sufficient blood supply might be maintained to preserve the integrity of the limb until an adequate collateral circulation was established. In cases of gangrene from obliterating diseases of the arteries, the collateral circulation vessels are already occluded. In such cases immediate reversion of the circulation is imperative. They state further that this cannot be accomplished at present because of the obstruction offered by the valves, because in many instances the circulating blood must also overcome the resistance offered by a thrombosed vein, and because the blood returns through the nearest communicating vein and does not reach the peripheral capillaries.

On the other hand, Bernheim, after a study of the cases in the literature, says that the evidence that he has gathered, while admittedly discouraging, has several points of interest and, all things considered, holds out hopes of better things to come. Fifteen of the operations were successful, a percentage, small though it may be, that would seem to controvert Coenen's views as to the impossibility of the procedure on physiological grounds.

Davies, of London, has recently done an end-to-end anastomosis between the femoral vessels for true gangrene of the toes of the left foot and threatened gangrene of the whole lower limb which has resulted successfully, the patient being able to walk with comfort six months after the operation. He expressed the same opinion as Bernheim, saying that it must be remembered that the number of patients on whom the operation of arteriovenous anastomosis has been performed for gangrene is small and that greater experience is required in order to determine the choice of case or of technic. The operation was not an easy one and the technic employed for controlling the hemorrhage and for uniting the vessels had varied greatly. There is no doubt that many of the cases operated on were not suitable on account of the state of the gangrenous part, the extent of the thrombosis, the advanced age or the bad condition of the patient.

H. Hauke, from his work on the cadaver, is not favorable to the procedure and is inclined to attribute the few successes realized to a natural spontaneous turn for the better.

Frank J. Corbett, of Minneapolis, attributes his failure to technical errors such as the too prolonged storage of blood in the vessel, interpolation of adventitia between the segments of the vessel, failure to remove small clots and fibrin ferment from the inside of the vessels, traumatism of the endothelium of the blood-vessels by the clamp, drying of the endothelium resulting from the tardy application of petrolatum, or too much time in operating. He believed that with a thorough knowledge of these principles and a complete application of all these details, success would attend the suturing of normal blood-vessels in a few fields, especially the repair of blood-vessels accidentally torn.

Dr. Howard Lilienthal, in discussing the views of Halsted and Vaughan, states that there are certain cases of diabetic gangrene in which the arteries alone are diseased where arteriovenous anastomosis will be found practicable. Where arteries and veins are both diseased it naturally does no good. Dr. Fred B. Lord,

of Boston, agrees with Halsted that the operation has a very limited field of usefulness

Dr John B Murphy, of Chicago, reports good results in anastomoses done for bullet wounds, in one case where the anastomosis was done between the carotid and jugular the results were perfect

We believe that this sketch gives a fair presentation of the present status of arteriovenous anastomosis. The number of successes recorded are sufficient to overthrow the arguments of those who are skeptical as to the possibilities of this procedure.

The reversal of the circulation in the extremity is applicable in arteriosclerosis, and also in arterial thrombosis where the integrity of the limb can be preserved until collateral circulation can be established.

In selected cases of angiosclerosis, the operation offers relief from symptoms which no other method of therapeutic measure can afford, excepting light amputation.

While we cannot explain why the blood, instead of reaching the peripheral branches, does not return by way of the anastomotic or collateral branches, the results obtained in animal experimentation and in human beings have proved that the blood does reach the peripheral vessels and that complete reversal of the circulation does take place. The absence of palpable pulse in the peripheral veins is explained by Wieting by the fact that the veins do not possess the rhythmic contractile power that the arteries do, he compares the condition to water running through a pipe attached to a pump, in which instance the water flows in intermittent volume, while at a distance from the pump the impulse is lost and it flows in a continuous stream.

Gallios and Pinatello in their experiments on the cadaver found that colored fluid when injected returned immediately by the other veins, and that even by clamping the collateral veins with forceps, the valves could not be forced.

In experiments upon dogs we, as both Carrel and Bernheim, have demonstrated that the arterial pressure will force the blood beyond the valves of the femoral vein, Bernheim also feels convinced that a similar phenomenon occurs in the human being. The constant pounding of the arterial blood against the valves of the vein, he says, gradually wears them down and forces them to give in the dog, why cannot a similar condition take place in the human? In commenting upon a case in which he operated successfully on both arms and both legs, Bernheim says in reference to this subject that the valves of the veins in both arms seemed quite close together, so that in each instance one

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set was not more than one-half or one inch below the site of the suture. This first set of valves held tightly for a few moments, but only a few, and then gradually gave way. It took a longer time for the second to give, but he definitely saw their destruction take place, the arterial stream seeming to batter down the cusps first on one side and then on the other. This phenomenon could be discerned by noting the admixture of arterial and venous blood. At no time was there a sudden rush of blood down the vein as though a whole set of valves had given away. Dr. Bernheim, therefore, believed, that if the arterial stream in a condition of lowered blood-pressure was able to overcome the resistance offered by the valves nearest the fistula, a higher, more normal pressure, such as occurs on regaining consciousness and subsequent health, would be able to force the valves further down in the course of the vein.

In lateral anastomosis unless the central end of the vein is ligated, most of the red blood will immediately return to the heart, through the central end of the vein, and, according to Carrel, the valves of the vein are not forced. This difficulty is overcome by end-to-end anastomosis, after which the valves give away in a short time and the red blood flows through as far as the capillaries and the arteries are filled with dark blood. This process takes in the dog, about three hours.

In our cases, the foot which had previously been cold and cadaverous in appearance took on a feeling of warmth and a healthy pink color. Valves were only a temporary barrier, if any, to the blood current against the constant pounding of the heart. Pain due to ischaemia has been relieved shortly after the operation in all of our cases.

Strongly presumptive evidence of the possibility of establishing a reversion of the circulation were the following facts: (1) Increase of warmth in the affected part, (2) improvement of color, (3) relief of pain, (4) filling of the superficial veins, (5) pulsation in veins below the site of the anastomosis, (6) return of the part threatened with gangrene or the actual seat of gangrene to the normal.

As previously stated, arteriovenous anastomosis is applicable to cases of endarteritis. We will not enter into a discussion of the analogy of Raynaud's disease, angio-sclerosis, endarteritis obliterans, angio-thrombophlebitis, erythromelalgia or arteriosclerosis of the extremities. Various authors have endeavored by clinical means and pathological findings to separate these conditions into different groups and to classify them as distinctly separate diseases. A careful perusal of the literature makes it apparent that the same clinical and pathological manifestations are described by all writers, with, perhaps, more impor-

tance laid upon one particular symptom by one author, while less stress is laid upon the same symptom by another

Beyond this it is unnecessary to consider the symptoms of these conditions, it being sufficient to remember that the above-named symptom complex described under the various names, leads to spontaneous gangrene of one or more of the extremities. All writers agree that the disease is an ascending process and while both arteries and veins may become involved, the changes in the arteries precede those in the veins. An observation of a large number of cases seems to indicate that the process rarely extends beyond the femoral vessels.

We should keep these facts before us in considering the cases to be reported and also the following points in technic. In isolating the vessels, preliminary ligation of all small branches is necessary, for this work the aneurism needle is superior to the clamps and all branches are ligated as they are exposed. I wish particularly to emphasize the importance of the careful removal of all adventitia from about the line of suture. The lumen of the vessel must be thoroughly perfused to remove all possible deposit of fibrin. The exposed vessels should be kept covered with liquid petrolatum, paraffin, or vaseline, to prevent their becoming dry. A neglect to follow these precautions will result in failure by inviting thrombosis.

By following these precautions we have been able to demonstrate conclusively that suture of the intima, with very fine silk sutures, will in a few days be completely covered. The intima will present a smooth, glistening surface over the line of anastomosis, with the silk completely isolated from the lumen of the vessels. By an observance of these points we have been able to demonstrate that vessel anastomosis can be accomplished without thrombosis, as the following report of cases will show.

CASE I—I K, storekeeper, aged thirty-five years, was referred to me by Dr I Seff. He was admitted to Beth Israel Hospital July 17, 1912, with angiosclerosis of the left leg and necrosis of the tip of the great toe and a large ulcer on the shin. He had a similar trouble with his right foot three years ago, for which an amputation below the knee had been performed.

According to his history of about one year's standing, he began to suffer pain in the great toe and later the pain extended to the foot and leg, the pain being particularly acute at night. About six months ago an ulcer appeared on the tip of the great toe, the toe became very much swollen and the entire tip appeared

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gangrenous Shortly afterward an ulcer appeared on the shin, this ulcer and the one on the toe refused to heal

When the patient was referred to me, he was only able to get about with great difficulty The great toe was swollen to about twice its natural size was dusky in appearance and the entire tip appeared necrotic and extremely sensitive and tender to the touch Elevation of the limb was followed by marked blanching of the foot, when the limb was suspended it became very mottled A shallow ulcer, about the size of a half dollar, occupied a position on the lower third of the shin Pulsation could not be felt below Scarpa's triangle, in either the popliteal, tibial or dorsalis pedis There was no œdema The examination of the urine was normal, the Wassermann reaction was negative Blood-pressure was between 110 and 130 The radiograph did not reveal any calcareous condition of the vessels

Operation was performed on July 22 The femoral vessels were exposed at the lower angle of Scarpa's triangle, and the femoral artery and vein were severed about 1 cm respectively above and below the point of anastomosis The proximal end of the femoral artery was then anastomosed to the distal end of the femoral vein with a continuous, circular Carrel suture, the free end of the vessels were ligated After the anastomosis was completed and the serrefines removed, the vein became distended and pulsated synchronously with the heart beat The wound was closed with catgut for the deeper sutures and silkworm-gut for the skin A long splint was applied

During the first twenty-four hours the temperature was 100° and the pulse varied from 80 to 100 I had ordered the head of the bed elevated, in order to favor the circulation to the limb, but the nurses, in accordance with the habit of raising limbs operated upon, placed several pillows under the leg, nullifying Fowler's position, as a consequence the patient suffered considerable pain When the limb was placed in the dependent position on the following day, the blanched appearance changed to a pink color and his pain was immediately relieved On July 24, the patient said "I am more comfortable than I have been for a year" On the fourth day the dressings were opened to inspect the limb, and very much to our surprise and satisfaction, we found the ulcer on the shin had taken on a healthy appearance and was healing At the end of ten days, this ulcer which had resisted all forms of treatment for six months, had completely cicatrized The swelling on the great toe was diminished and it had taken on a more healthy appearance

Two weeks after the operation a slight œdema was present

and the limb mottled On August 10, it was found that the operative wound, which had only apparently healed by primary union, showed evidences of fluctuation and the introduction of scissors was followed by a gush of clear serous fluid, which must have caused pressure on the vessels, for after it was evacuated, the œdema disappeared and the toe began to heal (this fluid was undoubtedly due to an excessive amount of vaseline which I had used during the operation to protect the vessels)

Three months later the toe was entirely healed The patient is able to get about without any discomfort and sleeps well, and without the aid of hypnotics or anodynes There is a distinct thrill and bruit heard over the area of anastomosis

Subsequent History—About seven months after the operation the patient was taken ill with severe angina and ran a high temperature A few days later an extensive erysipelas developed which involved the operated extremity The concomitant œdema of his leg persisted for several weeks and then subsided Since then the patient has been well and gets about without any discomfort

In the interim he had an ingrowing nail of the great toe excised, without producing any disagreeable after-effects

A loud thrill heard after the anastomosis is still present

CASE II—L W, age thirty-one, a presser, was admitted to Beth Israel Hospital, October 29, 1912 His family and previous history were negative There was no venereal history He smoked about twenty cigarettes a day and indulged moderately in alcoholics His present history showed that one year before admission he began to have attacks of stabbing pain in the great toe of the right foot, radiating up to the knee, and about this time he noticed that the foot and the lower part of the leg were mottled in appearance The foot became cold and pains gradually extended over the entire extremity so that walking became impossible on account of the pain, in spite of hypnotics administered at night, he was unable to sleep He was treated at the hospital without obtaining relief

I found the right foot cold and mottled in appearance There was no pulse in the popliteal, posterior tibial, or dorsalis pedis to be felt, upon elevation of the limb it would become completely blanched, upon lowering the limb the return circulation appeared in the leg in fifteen seconds and in the foot in three and a half minutes The blood-pressure was 124 in the right arm and 122 in the left The Wassermann test was negative

Operation was performed November 5, gas-ether anæsthesia On November 6, the temperature was 101° and the subsequent six days it ranged between 99° and 100°

November 10, upon elevating the limb, it became blanched, excepting the toes, when the limb was returned to the level of the bed, the whole extremity became pink in ten seconds (previous to the anastomosis in three minutes). His general condition was good. The patient received but one dose of a hypnotic after the operation.

The wound healed. Pulsation was felt along the course of the femoral vein and also over the popliteal space, synchronous with the heart beat. The blood-pressure of the femoral vein just above the knee was 126, the blood-pressure of both upper extremities was 128. The patient when discharged, December 17, had no pain. The superficial veins were somewhat dilated.

The pathological report of the specimens of vessels removed for examination was endarteritis and endophlebitis.

CASE III — J. R., an operator, twenty-eight years old, was admitted to Beth Israel Hospital, November 4, 1912. Previous history, usual diseases of childhood. He had been an excessive tea drinker and cigarette smoker. Four years ago he began to have a peculiar sensation of numbness of the left leg, which was followed by pain. This interfered with his walking. The foot became cold and, in appearance, lifeless. One year ago an ulcer appeared between the fourth and fifth toes of his foot, this gradually increased in size and the toes became gangrenous. The smaller toe came off spontaneously and the *gangrene extended to the other toes*. The pain had become unendurable. The patient presented a very anæmic and poorly nourished appearance. There was a moderate pulsation in the femoral artery. The glands of the left femoral region were very much enlarged and sensitive. The Pirquet reaction as well as the Wassermann were negative. The radiograph showed severe atrophy of all the bones of the foot; the arteries were not visible.

Operation was performed on November 13, 1912. An incision was made over the lower angle of Scarpa's triangle. A number of large, acutely inflamed glands were found about the femoral sheath and these were removed. Upon opening the sheath of the femoral artery we found a high bifurcation of that vessel. Of the two bifurcations, the larger was completely thrombosed, and the smaller one was still patent but thickened. This vessel was isolated with some difficulty on account of the venous branches in that area. The femoral vein was imbedded in glandular tissue and injured during its isolation, which necessitated resecting a portion of it. After both vessels were severed, the proximal end of the artery and the distal end of the vein could not be approximated without some tension, which caused the fine silk suture to

break, the anastomosis, therefore, was completed with No 1 surgical silk which was used without the usual method of sterilization, viz, sterilizing in vaseline

The patient was relieved of his pain for a few days, and then the wound suppurated, followed by thrombosis of the vessels. On December 9, the leg was amputated below the knee. He was discharged January 5, 1913.

Comment This was a case with progressive, preliminary gangrene and extensive lymphangitis with adenitis and should not have been considered for the operation.

CASE IV—S W, forty-one years of age, was admitted on November 13, 1912. His family history was negative. His previous history showed that he had gonorrhœa two years ago, but he denies syphilis although he had received two injections of salvarsan.

His present history dated back five years when he began complaining of burning pain in the calf of the left leg and sole of the foot. Ulcers formed on the great toe of the left foot, this toe became black and he suffered for about two years, when the ulcer finally healed and that leg had never bothered him again. About two and a half years before admission, similar symptoms occurred in the right leg, with ulceration at the tip of the little toe, this toe finally became gangrenous and fell off. An ulcer began on the great toe at the location of the nail, which has continued up to the time of admission to the hospital. He continued to have, oftentimes, excruciating pain and could not walk very far. There was a peculiar color of the toes and foot. Both feet showed an erythematous condition of the skin with a subnormal temperature of the right foot. Both the femorals were felt pulsating, the right popliteal was questionable, and the dorsalis pedis was not felt at all. The blood-pressure was 135. The Wassermann test was negative. The urine was normal.

Operation was performed on November 18, 1912, arteriovenous anastomosis of the right femoral vessels for angiosclerosis. Too much allowance was made for the retraction of the severed vessels so that, after they were united, there was marked angulation of the vessels. November 19, the patient seemed to be entirely relieved with the exception of a sticking pain in the region of the ulcer of the great toe. The color of the limb was normal, and there was some redness of the toes. On November 22, the wound was dressed and found to be clean. Pulsation could be felt all the way down to Hunter's canal. A portion of the nail of the great toe was removed. On November 29, the color of the foot was good, but there was a marginal necrosis of the distal

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end of the dorsal surface of the great toe. The distal phalanx was necrotic. On December 15, the wound of the great toe continued to become gangrenous and the pain more severe. On December 23, the great toe of the right foot was amputated. December 27 no pulsation felt nor sound heard with the stethoscope. The wound of the toe continued necrotic and very painful and there was a redness of the entire foot. On January 16, 1913 an amputation of the lower third of the femur was done.

An amputation at the junction of the upper and middle third of the leg was attempted at first but upon examination of the anterior and posterior vessels, they were found to be entirely obliterated and bleeding so very little that it was decided best to amputate the lower third of the thigh. The bleeding here was more profuse than lower down, but the distal portion of the femoral artery was entirely obliterated and the portion of the femoral vein which formed the anastomosis bled fairly well. The wound healed by primary union and the patient was discharged February 1, 1913.

The tissue of the great toe, was reported by the pathologist as showing evidences of chronic inflammation and marked atheromatous changes in the vessels.

Dissection of the amputated limb showed a thrombus at the bifurcation of the popliteal vein into the anterior and posterior tibial.

The angulation of the vessels after the anastomosis was completed probably (?) contributed to the thrombosis with obstruction of the circulation.

CASE V—J. D., forty-five years old, an awning maker. His father died of pneumonia and his mother of carcinoma (?). What diseases he had in childhood he did not recall. He had malaria thirty years ago. One year previous to admission to the hospital he had a frost bite of both great toes. He stated that his feet are cold most of the winter. He denied ever having had any venereal disease.

rational, his hair is perfectly white and he appears to be a man of 60 years. The arteries are not palpable. All the toes of the left foot are extremely *cyanotic*, slate-like in appearance, and without sensation. The temperature is subnormal and there is no odor. The examination of his general condition was negative. No pulsation was felt below Scarpa's triangle.

Operation was performed on November 24, 1912. A longitudinal incision was made over Scarpa's triangle, the femoral artery and vein exposed, severed and perfused with Ringer's solution. An end-to-end anastomosis of the femoral artery and vein was made. A distinct pulsation and thrill could be felt in the vein.

When the anastomosis was completed the foot appeared mottled and blue, shortly afterward the limb took a pink, healthy color which extended to the base of the toes. Two days later there was a line of demarcation at the base of the toes. Four days later gangrene extended to the dorsum of the foot. The thigh was amputated on December 9, there was found an ascending phlebitis with thrombosis of the veins.

We feel that in this instance operation should have been undertaken soon after his admission to the hospital and that an amputation near the line of demarcation, performed shortly after the anastomosis, would probably have averted the thrombosis of the vessels, which necessitated the amputation of the thigh.

This case was one of Dr. Lockett's and was admitted to the Harlem Hospital November 21, 1912. For the courtesy of reporting this case I acknowledge my indebtedness to Dr. Lockett who graciously invited me to operate upon the patient in his service.

CASE VI—H. K. was admitted to the Beth Israel Hospital December 10, 1912. He had typhus fever 24 years ago, otherwise his previous history was negative. He denies ever having had any venereal trouble. He had a marked cigarette habit.

His present history is of four years' standing, during which time he had suffered pain in his right leg particularly when walking. The foot was blanched in appearance and felt numb. Ten months previous to admission his great toe became gangrenous and was amputated. *This wound had not entirely healed up to the present time.* The pain was relieved for a few weeks after the amputation of the toe and then returned. The remaining toes became bluish in color, the foot very cold, and the pain was intense, especially at night.

Examination showed the foot to be mottled in appearance and cold, no pulsation could be felt below the middle of Scarpa's triangle. *The deep wound was covered with flabby granulations*

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end of the dorsal surface of the great toe. The distal phalanx was necrotic. On December 15, the wound of the great toe continued to become gangrenous and the pain more severe. On December 23, the great toe of the right foot was amputated. December 27 no pulsation felt nor sound heard with the stethoscope. The wound of the toe continued necrotic and very painful and there was a redness of the entire foot. On January 16, 1913, an amputation of the lower third of the femur was done.

An amputation at the junction of the upper and middle third of the leg was attempted at first but upon examination of the anterior and posterior vessels, they were found to be entirely obliterated and bleeding so very little that it was decided best to amputate the lower third of the thigh. The bleeding here was more profuse than lower down, but the distal portion of the femoral artery was entirely obliterated and the portion of the femoral vein which formed the anastomosis bled fairly well. The wound healed by primary union and the patient was discharged February 1, 1913.

The tissue of the great toe, was reported by the pathologist as showing evidences of chronic inflammation and marked atheromatous changes in the vessels.

Dissection of the amputated limb showed a thrombus at the bifurcation of the popliteal vein into the anterior and posterior tibial.

The angulation of the vessels after the anastomosis was completed probably (?) contributed to the thrombosis with obstruction of the circulation.

CASE V.—J. D., forty-five years old, an awning maker. His father died of pneumonia and his mother of carcinoma (?). What diseases he had in childhood he did not recall. He had malaria thirty years ago. One year previous to admission to the hospital he had a frost bite of both great toes. He stated that his feet are cold most of the winter. He denied ever having had any venereal disease.

His present illness began three weeks previous to his admission with dull, aching pain just below the left knee. The pain gradually descended to the foot, and within one week was located in the toes. For the past two weeks the pain had been located in the toes and was sharp and burning in character, and most severe at night. He walks with great difficulty, and has now no sensation in any of his five toes.

The physical examination showed the patient to be a white male, adult, 5 ft. 7 in., weight 140 pounds, fairly well developed but somewhat emaciated in appearance. He is conscious and

On December 16, the patient was anæsthetized and an anastomosis of the femoral artery and vein was done

On December 18, the bandages were removed. The entire foot was cyanotic, after removal, the circulation returned, except to the toes and about a third of the dorsum of the foot

On December 21, amputation was performed through the middle third of the leg. There was considerable hemorrhage on account of the return circulation

On December 28, the wound was clean, granulating in slowly where the margin of the flap had separated

By March the wound was healed. The patient had no pain and pulsation was felt in Hunter's canal

In applying the post-operative dressing in this case, the staff man inadvertently applied some turns of the bandage about the extremity so tightly, that when it was removed, a deep groove remained in the soft parts for some time. This constriction for two days following the anastomosis was, in my opinion, responsible for the extension of the gangrenous process

The bleeding during the amputation was profuse, necessitating the application of an Esmarch's bandage to be followed by ligation of a number of vessels, thus proving that there was an adequate supply of blood to the parts above the site of amputation

For the courtesy of being permitted to operate and report this case, I desire to acknowledge my indebtedness to Dr. Ladinski, Visiting Surgeon, Gouveneur Hospital

CASE VIII — R. L. was admitted to the hospital with the diagnosis of angiosclerosis. One year before admission the patient began to have pain in the left great toe. He said, that at first the toe became pale and red by turns, then there was a numbness of the entire foot and he had severe pain in the foot and the calf of the leg when walking

The pulsation in the left popliteal artery and tibial vessels was not palpable. In the left foot the return circulation was very slow, on lowering the extremity the great toe became mottled and cyanotic, which gradually spread to the other toes. Wassermann test negative

On January 15, an arteriovenous anastomosis was done. An oblique incision was made over the course of the femoral vessels. The artery was found to be very much thickened and of small caliber. A branch of considerable size was found running along the anterior surface of the femoral artery, this was ligated so that the artery might become more accessible. In attempting to ligate a small branch of the femoral vein, which ran directly across the artery about one-half an inch above Hunter's canal, the ligature

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at the site of the head of the first metatarsal bone, discharging pus. The inguinal glands were enlarged. The blood-pressure was 126. The Wassermann reaction was negative.

Operation was performed on December 14, 1912, an arterio-venous anastomosis of the femoral vessels being done. The artery was found to be sclerosed and thickened; the vein was also thickened.

The highest post-operative temperature was 100.4°.

On December 20, there was heard a loud thrill over the femoral vein. *The wound on the foot was dry.* The operative wound had healed. The patient was discharged January 15, 1913.

Pathologist reported a marked chronic endarteritis and endophlebitis.

CASE VII.—J. G., with family and previous history negative, stated that thirteen months ago he had his left leg amputated, in the Presbyterian Hospital. Six months previous to that time, the second toe of the left foot became numb, then grew cold and discolored; next the third toe became involved; the process spread gradually until the middle third of the leg was reached; then the patient went to the hospital for treatment. An amputation was made through the thigh. There was present a chronic endarteritis.

The present history showed that two weeks after his discharge from the hospital, the third toe of the right foot began to grow numb, cold and discolored, exactly as the toes on the amputated foot had done. The patient consulted several physicians who told him that all he could do was to wait for further developments. The patient finally decided to come to the hospital for treatment.

On November 22, 1912, the physical examination, with the exception of the lower extremities, was negative. The left leg had been amputated through the middle third, and the stump had healed. There were no sinuses, and there was no tenderness on pressure. The third toe of the right foot was discolored and insensible and there was a line of demarcation in the middle of the proximal phalanx. There was a lymphangitis on the dorsum of the foot.

On December 5, the patient complained of intense pain in the affected member, particularly at night; he slept very little and the usual sedatives had no effect.

On December 10, small areas of phlebitis appeared on the dorsum of the foot and at the base of the toe; there was no pulsation in the popliteal artery. The Wassermann reaction was negative.

and posterior tibial and the dorsalis pedis arteries. The entire foot was hyperæmic and congested. There was gangrene of the fourth toe with ulceration of the dorsal surface and gangrene of the third toe. All the vessels in the right extremity pulsated.

When admitted to the hospital he had a lymphangitis of the foot with gangrene and ulceration of the fourth toe. The Wassermann test was negative. Diagnosis, angiosclerosis of the left leg.

On February 3, an end-to-end anastomosis of the femoral artery and vein was performed. The sartorius muscle was retracted outward. The vessels were readily recognized, the femoral artery was found to be of normal caliber but very much thickened, the vein was of the same caliber as the artery. Upon completion of the anastomosis and the return of the circulation to the vessels, they relaxed so as to form a sharp angulation just above the site of the anastomosis. As this was an unfavorable condition, the anastomosis was excised and the vessels sutured again.

On February 4, the post-operative temperature rose to 101.4° and then dropped to normal.

February 7, the wound had healed by primary union. The patient was entirely free from pain. The fourth toe was gangrenous.

On February 20, the temperature was normal. The patient complained of severe pain in the entire leg.

February 23, the temperature was 100° . A line of demarcation was well defined with but a small gangrenous area on the dorsum of the foot. Amputation was deferred and on February 25, the temperature rose to 106.4° and the pulse 136. During this period the gangrene of the foot spread rapidly. The patient was very restless and had severe pain. The left leg was amputated above the knee, the femoral vein bled freely. On examining the amputated limb the following was found. Just below the popliteal space, both the anterior and posterior tibial veins were found to be filled with fresh clot, the arteries were entirely obliterated.

The pathologist reported this to be a case of thrombo-angietis obliterans.

After the amputation the patient improved, the stump healed by primary union and the patient was discharged March 7, 1913.

Comment. Amputation in this case should have been undertaken as soon as the line of demarcation had become defined.

CASE X—Mrs. K. D., aged eighty-seven, was admitted to the Montefiore Home August 24, 1909. The clinical diagnosis was

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slipped and the vessel retracted and bled, causing some hemorrhage into the sheath of the vein.

After exposing about one and a half inches of the femoral artery and vein, the ligatures were applied distally to the artery and proximally to the vein. The artery and vein were approximated with three tension sutures and anastomosed with a continuous circular suture; two extra sutures were required to control hemorrhage where the vein had to be puckered to adjust it to the smaller lumen of the artery. Upon removal of the clamps, the vein pulsated vigorously and a distinct thrill could be heard over the course of the vessel. The muscle was sutured with plain catgut and the skin was closed with silk. Well-padded splints were applied and a water pad was placed under the heel.

On January 16, immediately after the operation, the foot appeared somewhat cyanotic. The temperature ran up to 102° and then dropped to normal.

January 17, the foot was warm and pink in color. There was some pain over the tendo Achilles which was due to pressure.

On January 18, the color of the toes was pink. The patient felt comfortable. The wound showed some induration at the middle and lower angle; the skin wound opened and was drained with rubber tissue. The induration gradually lessened and the wound assumed a healthy appearance.

On February 7, pulsation was felt in the popliteal space. The patient's temperature was 104° ; his throat was red and congested; he complained of headache and was somewhat prostrated. These symptoms gradually subsided and on February 11, his temperature was again normal.

February 11, the patient complained of some pain in the left thigh. Upon examination of the wound, an induration was found, deep-seated, about the area of the anastomosis. The line of incision opened and an extravasation of blood about the anastomosis was found and the wound was packed.

The wound granulated rapidly and the patient was discharged on March 7.

On March 27, the circulation in the foot and leg was found to be good. The pulse was felt over the popliteal and the external saphenous veins.

This case emphasized the extreme importance of the utmost care in the ligation of all bleeding vessels.

CASE IX.—M. G. was admitted to the hospital, January 28, 1912, complaining of severe pain in his left foot and unable to sleep at night. Pulsation was absent in the popliteal, the anterior

War the patient had his left leg tightly bandaged above the knee for two days, which resulted in a marked swelling of the leg. This was done to feign injury, in order not to have to serve in the army. The swelling disappeared in two days.

His present illness dates back to one and a half years before admission, when he noticed a drawing pain in the calf of the left leg. The patient claimed that the muscles became very hard, painful and tender to the touch, after massage, this hardness disappeared for a few months.

About one year ago he began to feel a tingling and numbness of the foot and ankle after walking half an hour. Six months ago the foot became bluish in color and generally painful. Two months ago, in addition to the discoloration, an ulcer appeared at the back of the small toe, this ulcer gradually enlarged and became very painful.

The left foot was hyperæmic and pinkish in color and the return circulation was very slow. There was an absence of all pulsation in the entire left extremity, except the femoral. There was a trophic ulcer on the plantar surface of the fourth toe.

The Wassermann test was negative. Urine normal.

An arteriovenous anastomosis of the femoral vessels was done on March 1, 1913, for angiosclerosis.

March 1, end-to-end anastomosis of the femoral vessels. The vessels were exposed by retracting the sartorius muscles inward. In isolating the vein, a branch giving posteriorly and leading down into Hunter's canal, was injured, the bleeding from this branch was temporarily controlled by the Dorrance clamp, applied around the femoral vein. When the clamp was removed after the completion of the anastomosis, the bleeding continued and could not be controlled by packing. It was necessary, therefore, to dissect up Hunter's canal a short distance and the bleeding branch was exposed and ligated with silk.

On March 6, pulsation was felt below the line of incision and in the popliteal space, a distinct bruit was heard below the line of incision.

March 11, a loud, distinct bruit was heard over the entire length of the thigh, popliteal pulsation was felt.

March 20, pulsation in the popliteal and the thrill plainly heard. The wound under the surface of the fourth toe of the left foot was dry. The patient complained of excruciating pain up to the knee. When the limb was elevated it became blanched and the patient complained of severe sticking pain in the tips of the toes.

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senility and endarteritis obliterans. Her left limb had been amputated above the knee for gangrene of the foot in June, 1909.

On January 20, 1913, she complained of severe burning pain in the sole and the dorsal surface of her foot; the foot was cold and the *dorsalis pedis* was not palpable. There was a slight cyanosis of the extremity.

On February 10, the pain continued and was very severe. The foot was cyanotic and extremely sensitive to the touch; it became blanched upon elevation of the limb. There was no pulsation in the *dorsalis pedis* nor posterior tibial arteries.

February 12, the foot was cold, especially the second and third toes, which looked gangrenous; the dorsum of the foot was somewhat œdematous. Lymphangitis over the anterior surface of the ankle; when the limb was suspended it became blanched; and when the limb was lowered it was cyanotic and dusky in appearance. Pulsation of the femoral artery could be felt; the vessel atheromatous.

Arteriovenous anastomosis of the femoral vessels was done on February 13; the artery was found to be sclerosed, calcareous and atheromatous, so that the sutures were introduced with great difficulty. After the operation the pains in the affected limb decidedly diminished.

On March 3, a line of demarcation was defined over the dorsum of the foot and toe; these parts were dry and mortified in appearance. The remainder of the extremity was warm and the general appearance of the limb seemed to indicate a good blood supply. Pulsation was distinctly felt along the femoral and popliteal veins. The patient had no pain the second day after operation.

On March 5, under morphine-ether anæsthesia, a circular amputation was done, through the lower third of the leg. There was considerable venous bleeding; the *venæ comites* of the posterior tibial bled vigorously when severed; the arteries were completely thrombosed and calcareous.

The dissection of the foot showed thrombosis of the posterior tibial arteries and of the posterior tibial veins, below the internal malleolus; the other veins did not seem to be thrombosed. The wound healed.

Comment: This case shows that there is no age limit to the operation; had the operation been undertaken before evidences of gangrene had already set in, it is safe to presume that amputation of the foot would not have been necessary.

CASE XI.—I. E., a Russian, age thirty-five years, was admitted February 25, 1913. During the time of the Russian-Japanese

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March 27, the pain was relieved and the wound at the base of the fourth toe was dry.

Patient became impatient and insisted upon being discharged. He went home and fell into the hands of a quack, who evidently massaged his limb with croton oil. Patient readmitted to hospital four weeks later with the entire extremity covered with hundreds of small furuncles which caused him so much pain, that he begged for amputation.

Distinct pulsation felt in popliteal vein.

May 22, 1913, anastomosed vessels were exposed and excised before amputation was performed through the thigh. The specimen removed (Fig. 1) showed a smooth intima with line of union between the vein and artery hardly discernible; no evidences of thrombosis. Distal end of femoral artery which had been ligated at time of first operation, contained well organized thrombus.

CASE XII.—A. K., aged thirty-five years; admitted to the hospital on February 20, 1913.

One year before admission he began to have pains in the right leg and a sensation of cold in his toes when exposed to the cold weather. He limped.

He had been operated upon at Rochester, Minn., for a small red swelling on the inner side of his right leg, which entirely relieved him.

Six months ago he complained of pain in his left leg; the toes were cold and the pain was continuous day and night; worse when walking and somewhat relieved when lying down. The left foot was never swollen. The toes of both extremities were pale and somewhat cold. There was no pulsation in the popliteal arteries nor the dorsalis pedis of either side. The Wassermann reaction was negative; the urine normal.

February 24, arteriovenous anastomosis of the femoral vessels for angiosclerosis. There was no rise of temperature after the operation. The patient complained of pain for a few days, and since that time, he has been absolutely free from pain. The toes were warm and the circulation was good.

On March 3, the wound was dressed and the alternate sutures were removed. Distinct bruit heard all the way down to the popliteal.

On March 6, the remaining sutures were removed. The color of the foot was good and the pulse was felt at the line of incision and below. Thrill was felt all over the course of the femoral vein; pulsation felt at the lower angle of the popliteal space.

March 20, the patient complained of some pain at the heel, especially the under part. He limped slightly on account of a small blister.

March 23, blister healed and was free from pain.

April 22, bruit was heard all the way down to the toes. The circulation was good and the patient was free from pain.

The pathologist reported this to be a case of chronic arteritis with calcification of the intima.

CASE XIII —H. W., age fifty-two years, a Russian, admitted to the hospital March 5, 1913. Three or four years before admission he suffered pain in the left extremity, which was more severe at night. Six months ago the pain became worse and at night he was unable to sleep. Three weeks before admission the second toe became discolored, the nail came off, and ulceration of the toe resulted, the part was very painful and tender to the touch.

Upon examination of the limb, the popliteal vessels and the dorsalis pedis could not be felt in either extremity. The left foot showed discoloration of two inner toes. There was some redness of the left foot to the astragalus and the whole foot was cold.

Wassermann reaction negative, urine normal.

March 10, 1913, arteriovenous anastomosis of femoral vessels for angiosclerosis. Both the femoral artery and vein were found to be very much thickened, a thrombus was found in the artery and removed. The suturing of the vessels was accomplished with great difficulty, as the vessels were so thick and calcareous that the delicate silk sutures were cut and gave way.

March 11, the toes were pink and the ulceration on the second toe was dry. The patient did not complain of any pain whatsoever. No hypnotics were given.

On March 14, pulsation was felt in the popliteal, and above and below the anastomosis. The second toe was gangrenous and infected, and there was a bleb over the small toe. There was a lymphangitis of the entire foot. The wound of the thigh healed by primary union.

March 15, amputation of the lower third of the leg was done. There was bleeding from the posterior tibial vein and blood spurted from the anterior tibial vein.

Marginal necrosis of part of the line of suture caused some gaping which gradually granulated.

April 7, patient was seized with temperature of 104° and evidences of ascending phlebitis. Amputation of thigh.

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He developed extensive post-anæsthesia pneumonia from which he did not recover. Died May 4.

CASE XIV.—R. Z., a tinsmith, age thirty-one, was admitted to the hospital. He had a marked cigarette habit and denied ever having had any venereal disease. Wassermann reaction negative.

His history was of two years' standing. He had pain in the right limb and cramps in the calf of the leg, which were so severe, that the patient was unable to walk. He slept very little.

Pulsation of the femoral artery could not be felt. At the earnest entreaty of the patient, we made an exploratory incision on December 29, 1913. The femoral vessels were exposed; the artery was completely thrombosed, so that no pulsation could be felt below Poupart's ligament; therefore, no anastomosis could be accomplished. The wound was closed.

The patient refused to submit to an amputation and was discharged.

Two months later gangrene necessitated an amputation of the thigh, which was performed in another hospital. The femoral and tibial arteries were found occluded by thrombi.

CASE XV.—In December, 1912, I was invited to operate upon a similar case in Englewood, N. J., and found the femoral artery, upon exposure, to feel like a whip cord. The vessels were not opened and the wound was closed.

When pulsation of the femoral artery cannot be distinctly felt in Scarpa's triangle, operation should not be attempted.

CASE XVI.—B. L., age thirty-eight years, driver, admitted to Beth Israel Hospital May 1, 1913.

Previous history negative. Marked alcoholic and cigarette habits. Denies venereal history. Present history: five weeks ago he began to have a tingling sensation and numbness in the toes of the right foot; two weeks ago he had burning sensation in the same extremity followed by discoloration of the entire foot; acute pains, which had become unbearable, were added to the other symptoms. Temperature normal; pulse 96. The right foot was cold, cyanotic and devoid of sensation as far as the tarsal and metatarsal articulations. The whole foot was extremely painful; some lymphangitis along the anterior surface of leg. No pulse in the dorsalis pedis nor posterior tibial arteries.

Operation (May 3).—Femoral vessels exposed in Scarpa's triangle; artery found to be considerably thickened. Side-to-side anastomosis was done, with proximal ligation of the vein, according to the technic described by Bernheim; both vessels being incised to about one-third their respective circumference with a

Graefe knife The introduction of the sutures was accompanied with great difficulty on account of the depth of the vessels

There was no improvement in the appearance of limb post-arteriovenous anastomosis Two days later evidences of ascending phlebitis with temperature and rapid pulse

May 5, amputation of the thigh

Veins found filled with blood-clot extending all the way to point of anastomosis

A review of this series of cases shows six successes Several of the cases which promised success, later required amputation (eight cases), but even these patients received temporary relief from pain In several instances the operation should, perhaps, not have been undertaken, but on the whole, the results seem to warrant the conclusion that the procedure is well worth trying in suitable cases, as it affords the only hope, except amputation, for the patient threatened with gangrene

The ages of our sixteen cases varied from 28 to 87 years There were 13 end-to-end anastomoses, 1 side-to-side, and in 2 of the cases, an exposure of the vessels showed that an attempt to anastomose was not warranted, on account of the advanced stage of thrombosis of the vessels In two of our cases with gangrene, a low amputation seemed to be satisfactory

Of the eight cases which were failures, including one death, one was a side-to-side anastomosis, and three of the remainder should not have been operated upon on account of the presence of spreading gangrene

In experimenting upon animals we have tried all the usual methods of procedure, end-to-end, side-to-side, end-to-side, intubation, invagination, etc In all our operations upon human beings we have used the end-to-end operation, with only one exception, because we found it to be the simplest in execution and least likely to be followed by thrombosis

Wieting and Bernheim, however, believe that the operation of the future will be a lateral anastomosis, and the latter advocates a method whereby the artery and vein are incised transversely through one-third of their diameter and then sutured. Before turning on the blood stream the vein is tied off proximally to the site of anastomosis to prevent back flow to the heart

The operation should not be undertaken in the presence of sepsis or advanced gangrene The opportune time for intervention is in the pre-gangrenous stage, before mortification has appeared, in order to prevent its inception In non-septic gangrene, the improved nutrition

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of the limb may be hoped for, permitting lower amputation of the limb than would be otherwise possible, as is shown in several of the cases reported in our series.

The operation should not be undertaken in the presence of fulminating gangrene, neither should it be undertaken without a perfect knowledge of the technic. The utmost delicacy and skill in the minute details must be observed in order to avoid the formation of thrombi. A most rigid asepsis must be observed throughout, or the object of the operation will be defeated. To reduce the danger of thrombosis to a minimum, we have practised the following precautions:

Before the sheath of the vessel is opened, the wound is absolutely freed from and dried from visible blood, and then covered with sterile wound protectors. We have used various materials for this purpose and have found that a thin black oriental silk is best adapted to this purpose. This material adapts itself to the wound without encroaching upon the operative field and the color removes the glaring and trying effect of the open wound on the eyes of the operator, during the more minute details of the operation.

Of course we can only hope that the operation will relieve the symptoms, avert impending gangrene, and save the limb.

The etiology of the condition which requires this operation is still obscure. With a view of throwing some light on this subject, we have enlisted the coöperation of the laboratories of the hospital and hope in the future to be able to advance some information regarding the disease.

The predisposing factors in the causation of the symptom complex of this disease and the results so far obtained by operation warrant us in believing that, when the operation is undertaken before gangrene has actually set in, the distressing symptoms can be relieved without sacrifice of the limb to amputation, which hitherto has afforded the only means of relief.

REFERENCES

- San Martin y Satrustegui: Real. Acad. de Med., Madrid, 1902, El Jurado medico farmaceutico, Madrid, 1902, Semaine Medicale, 1902, p. 305.
Franz: Langenbezk's Arch., 1905, S. 572.
Carrel: Bull. of the Johns Hopkins Hospital, 1907, vol. xviii.
Carrel and Morel: Lyon Med., 1902, pp. 114 and 153; Provence Med., 1902, pp. 329-356.
Carrel and Guthrie: Amer. Med., 1905, p. 284; ANNALS OF SURGERY, 1906, p. 203.
Hubbard: Boston Med. and Surg. Jour., 1906, p. 647; ANNALS OF SURGERY, p. 559.

MELANOBLASTOMAS OF THE FOOT (CHROMATOPHOROMA, MELANOMA, MELANOSARCOMA)

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ONE finds scattered through the literature reports of certain tumors of the foot which follow similar clinical courses but which have been separated into different groups upon histological grounds. Eleven cases of this kind have come under our observation and have led us to suspect that the structural differences among them are only apparent and that in fact a common origin can be attributed to them.

They are either ulcerous or fungoid lesions which occur usually upon the sole, sometimes upon the ankle, and rarely upon the dorsum. They grow slowly, tend persistently to recur if excised, and metastasize by the lymphatics, forming secondary tumors along the lymph-vessels as well as in the nodes of the groin. Later they may be disseminated by way of the blood-vessels into the lungs, liver, skin and other organs. They originate apparently from groups of subepithelial cells resembling the embryonal cells common in moles. These cells form pseudo-alveoli and also infiltrate widely. Some of the tumors are frankly melanotic. Some which have the same histological structure and similar histories contain no pigment. Some similar in other respects have pigment in the primary tumor but none in the secondary or *vice versa*. In one case at least, the tumors appeared free from pigment and yet the urine, though clear when voided, yielded a black pigment in the presence of oxidizing agents.

We present in this paper the histories of the cases observed by us, an analysis of them and a study of cases collected from the literature. An attempt is made to outline the life history of these tumors, to emphasize their common origin and to suggest such measures of treatment as appear logical.

CASE I—Male, aged sixty. Patient of Dr N A Seehorn, of Burrton, Kansas. Arteriosclerosis. A year and a half ago the patient noticed a small ulcer barely 1 cm. in diameter on the sole

of the foot It gradually enlarged to its present size (Fig 1) When examined the ulcer measured 2 x 2.5 cm and varied from 0.5 to 1 cm deep It was quite insensitive to touch but caused some pain in walking. When first seen the ulcer presented a punched-out appearance At the time the photograph was taken it still was well circumscribed, though there were circular areas of advancement about the border, indicating that the growth was extending in the subdermic tissue and involving the skin secondarily The floor of the ulcer was covered with pale red uniform granulations which were free from incrustations, had no white points and did not bleed readily The lesion was elastic rather than dense The lymph channels and glands were not involved

It was excised by a wide margin down to and including the tendon of the short flexor and was allowed to heal by granulation A section from the edge of the ulcer presents cells arranged in spherical masses which extend upward to the epidermal cells but do not involve them These cell masses are separated by fine bands of fibrous tissue Groups of these cell masses are again divided from other groups by heavy bundles of fibrous tissue This gives the section somewhat the appearance of a racemose gland the lumina of which are filled with cells In some regions, particularly in the advancing border of the tumor, long columns of cells extend peripheralward between dense bundles of fibrous tissue These are continuous with the spheroidal groups above mentioned and have the same kind of cells The latter are round, spheroidal or even spindle-shaped and have long granular nuclei surrounded by a moderate amount of protoplasm The blood-vessels run in the connective tissue and nowhere come into contact with the tumor cells

The patient remained free for a year and a half At that time tumors began to appear along the course of the lymphatics and in the groin No further treatment was attempted

CASE II—Male, aged sixty-four Patient of Dr T W Reid, of Wellsville, Kansas For several years he has had a gradually enlarging ulcer below the external malleolus on the left ankle (Fig 2) It was somewhat painful Upon examination there was a hemispherical mass 3 centimetres in diameter projecting from a defect in the skin, bordered by a zone 1 centimetre wide from which the epidermis had exfoliated The tumor was deep red, granular, elastic, clean, and did not bleed on touch It had been X-rayed for a month by Dr R L Sutton without apparent results Amputation was done midway between ankle and knee The specimen upon microscopic examination showed the effect of the X-ray A mere indication of the cell groups of the preced-

ing case is apparent. The cells remaining are degenerated and spindleform, the vessels are sclerosed and in part obliterated, and the fibrous tissues refuse the specific stain. A year and a half later glands appeared in the groin, which attained the size of an egg but regressed when iodine was rigorously applied. Since then, about a year, they have remained stationary.

CASE III—Male, middle-aged. Patient of General Hospital, Kansas City, Mo (courtesy of Dr Van Atta). Duration 6 years. The tumor was hemispherical and extended across two-thirds of the sole of the foot and up its inner aspect for 2 or 3 cm. The skin surrounding it was jagged and irregular but free from the tumor. The central portion of the tumor was whitish, irregular and lobulated and contained no white points. The border was brownish-black (Fig 3). The mass was firm and elastic. There was a lymph-gland in the groin 6 cm long and 4 cm in diameter (Fig 4). The foot was amputated and the gland removed. The result of the treatment is not known.

The cells in this specimen are larger than in the preceding cases and are less disposed to alveolar arrangement, although in some regions these formations are distinctly present. The prevailing distribution of the cells, however, is a diffuse one with a general tendency to form columns. The connective tissue enclosing the individual cells stains well but the fibre bundles surrounding the smaller groups of cells stain badly or not at all. There is a distinct layer of perfectly staining connective tissue between the tumor cells and the epidermis. The cells are large, spheroidal for the most part, with granular ovoid nuclei and fairly abundant protoplasm. Some of the cells are ovoid with less protoplasm and some are distinctly spindleform with protoplasmic processes several times as long as the nuclei. In some regions the cells are separated from each other by a fine reticulum of poorly staining connective tissue. The blood-vessels are confined to the heavier bundles of connective tissue. The tumor from the groin presented on section a white surface with heavy, dense, pinkish bands traversing it. Near the surface was a disc of calcification 1 to 2 cm in thickness. The structure of the gland resembled the primary tumor but the cells were fewer and more elongated and the connective tissue was more abundant.

CASE IV—Male, aged fifty-four. Patient of Dr J G Sheldon. The tumor was first noticed two years ago. It presented a granulating mass 5 cm in diameter. The granulations were even and elastic and did not bleed easily but were covered in some parts with incrustations (Fig 5). The skin border was well delimited from the tumor, was irregular, and showed circular areas of degeneration where the underlying tumor was forcing its way through the otherwise normal skin. There was a chain

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of tumors extending along the lymph-channels which parallel the large blood-vessels from the popliteal space to the groin (Fig 6) The patient's general condition was good No treatment was advised

CASE V—Middle-aged woman Tumor began as a small black spot about 5 years before The lesion was 2 cm in diameter, brownish-black in appearance, and with an elastic irregular border The surrounding skin was roughened by small melanotic masses extending upward beneath it, but did not seem involved directly in the process (Fig 7) The tumor was excised locally The subsequent history of the patient is not known

The epidermis overlying the border of this tumor sends long processes like exaggerated interpapillary bodies down into the tumor mass Between these finger-like processes are groups of large densely pigmented cells The pigment occurs mostly in the cells but some granules are seen outside them From these groups of pigmented cells the tumor columns extend downward and soon lose all trace of pigment, though in some regions the pigment is present in small amounts for a considerable distance from the surface The deeper cells which contain no pigment are ovoid and arranged in alveoli In some small areas this cell massing is absent and the cells are less uniform in size and shape, many spindle-shaped cells with long processes being found among them The blood-vessels are confined to the larger bundles of connective tissue

CASE VI—Female, aged forty-six This patient had a large pigmented, fungoid, nodulated tumor which projected 3 or 4 cm beyond the sole of the foot The surface was mottled (Fig 8), firm, elastic and not easily injured It was free from serrations and debris

The leg was amputated at the point of election The ultimate result is not known

On section the midportion was deeply pigmented while the periphery presented large areas quite free from pigment The extreme anterior end presented another area of slightly pigmented tissue (Fig 9) This tumor showed less tendency than the preceding to extend to the surrounding tissue Histologically the tumor consists of spheroidal and elongated cells running parallel with each other and perpendicular to the surface of the tumor In the portion of the tumor which appears black on gross inspection both types of cells are sometimes pigmented and sometimes free from pigment The white portion of the tumor differs from the melanotic portion only in the absence of pigment Because of the large size of this tumor its relation to the skin could not be satisfactorily studied, but where it encroached upon the skin it appeared quite independent of the epidermis

CASE VII—Male Photo loaned by Dr J W Perkins This tumor in its relations differs from the preceding cases and furnishes a transition between them and those to follow It is fungoid and sessile and about 4 cm in diameter The summit has an irregular granulated surface, while the side is covered by an attenuated, imperfect epidermis The pigment is so distributed as to give a mottled appearance (Fig 10)

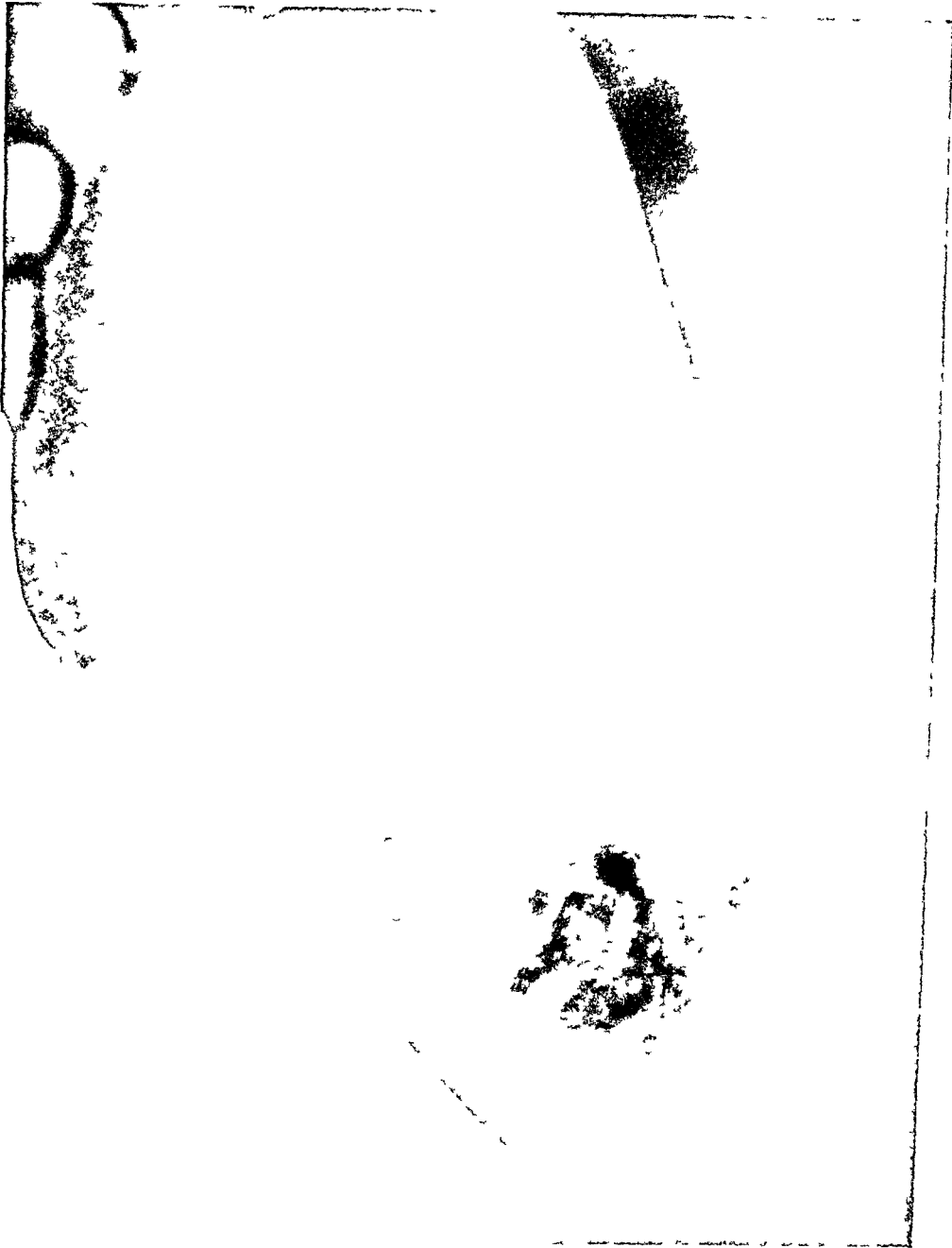
CASE VIII—Male, aged sixty The tumor was first noticed 8 years ago as a small black spot which at times exuded a little fluid, so that the clothing adhered to it The photograph of the leg (Fig 11) was taken six months before the tumor was removed and the cross section photographed (Fig 12) In this time it had doubled in size At the time of operation the summit was pigmented and irregular and covered with elastic granulations, except at one point where bleeding had recently occurred The periphery was covered with a thinned epidermis which extended about the tumor like the hull of an acorn

On section the surface appears mottled from the intermingling of pigmented and pigment free areas The epidermis is everywhere separated from the tumor by a considerable layer of connective tissue Beneath the latter are cavities lined by many layers of ovoid cells with ovoid granular nuclei Those nearest the centre are heavily pigmented In some regions one sees solid columns of cells resembling those in specimens previously described which are continuous with the cell-lined cavities

CASE IX—Female, aged nineteen Patient of Dr G A Nickelson, Plains, Kansas A year and a half ago the patient noticed a small spot on the skin over the tibia at about the junction of the lower and middle third of the leg It was excised A year later masses appeared in the adductor group of muscles and in the groin These also were excised When the patient was examined there was a return of the primary lesion on the skin and a mass on the inner surface of the thigh, extending from a hand-breadth above the knee well above Poupert's ligament The mass was very dense and but slightly movable The patient's general health was perfect

The tumor mass in the thigh was removed in one piece (Fig 13) The recurrent tumor likewise was removed The femoral artery and vein were freed from a point 5 cm above Poupert's ligament to the lower end of Hunter's canal The long saphenous vein at the point of entrance into the femoral was invaded by the tumor and had to be excised flush with the surface of the femoral vein Sections of this tissue presented scattered ovoid or spindle cells imbedded in dense masses of connective tissue

FIG 1

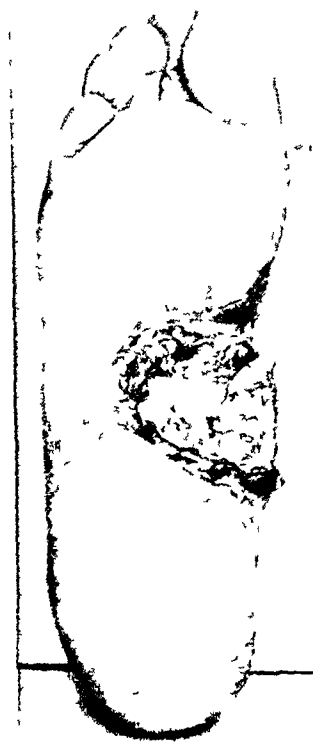


Melanoblastoma of the sole of the foot Accessory nodules perforating the skin at the border of the main tumor



Melanoblastoma on the outer surface of the heel The tumor mass protruding through the surrounding exfoliating skin

FIG 3



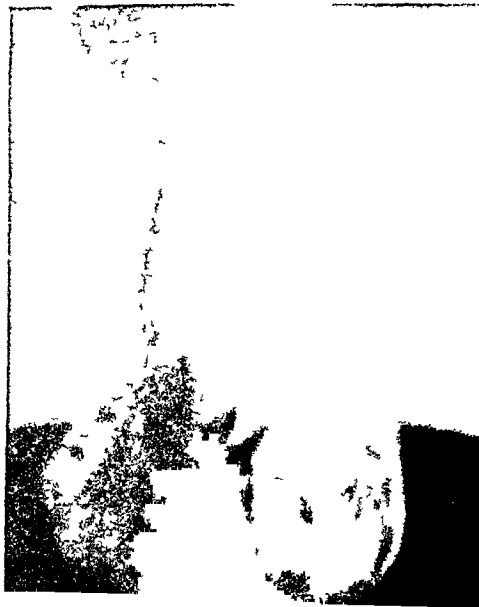
Melanoblastoma of the inner border of the foot The border of the tumor is melanotic the centre non-pigmented

FIG 4



Lymph gland from groin in melanoblastoma of the foot

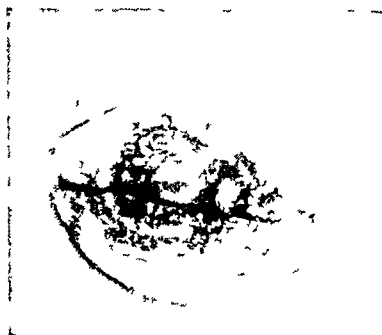
FIG 5



Melanoblastoma of the heel Tumor protruding through the unaltered skin

enlarged lymph-nodes below Poupart's ligament in case of melanoblastoma of the sole of the foot

FIG 7



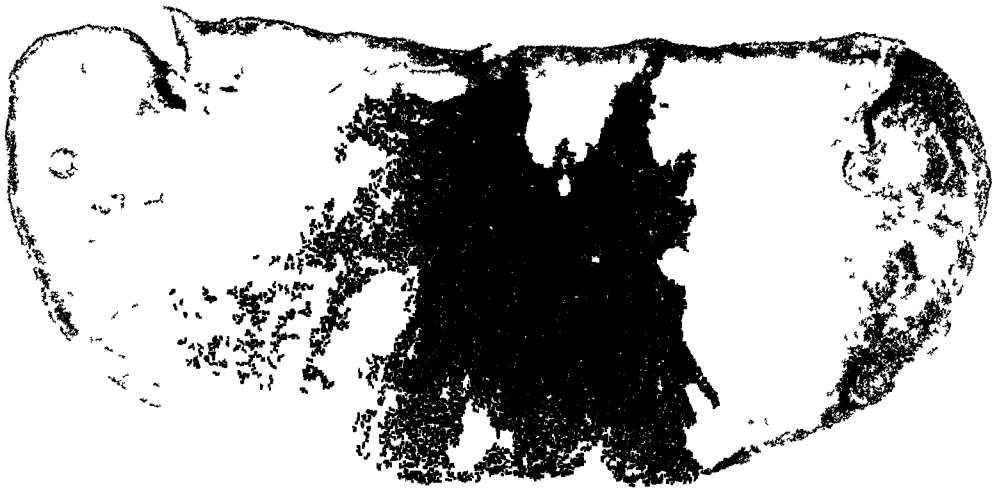
Pigmented melanoblastoma of sole of foot Protruding tumor eroding surrounding skin

FIG 8



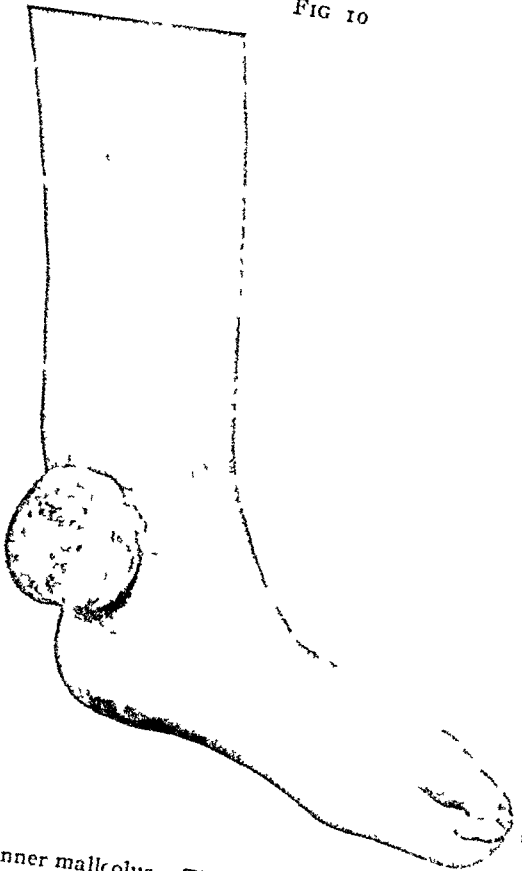
Large fungating melanoblastoma of the heel The surrounding skin is unaffected

FIG 9.



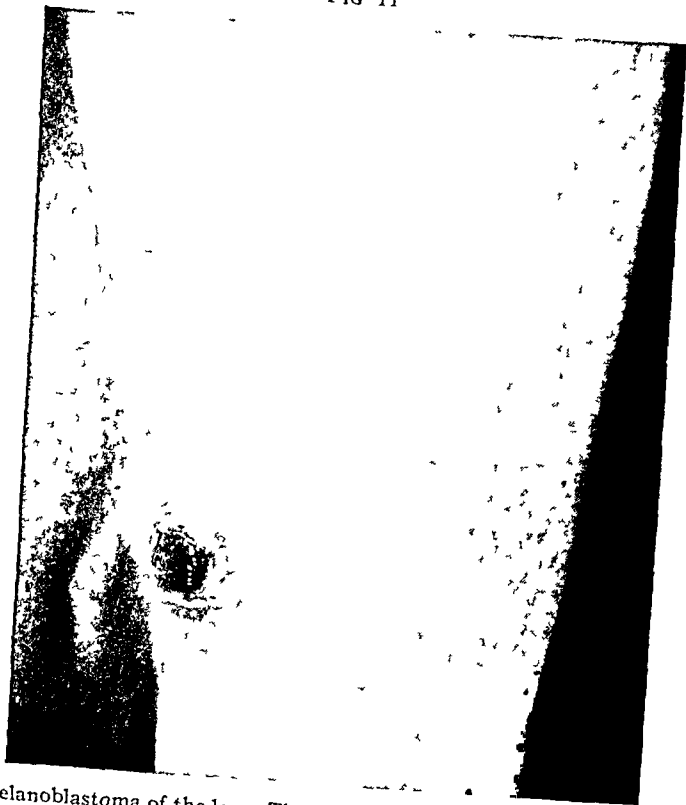
Cross section of melanoblastoma of the heel Pigmented areas alternate with pigment free areas

FIG 10



Melanoblastoma of inner malleolus The covering skin is thinned and defective

FIG 11



Melanoblastoma of the leg The skin covering it has become eroded

FIG 12



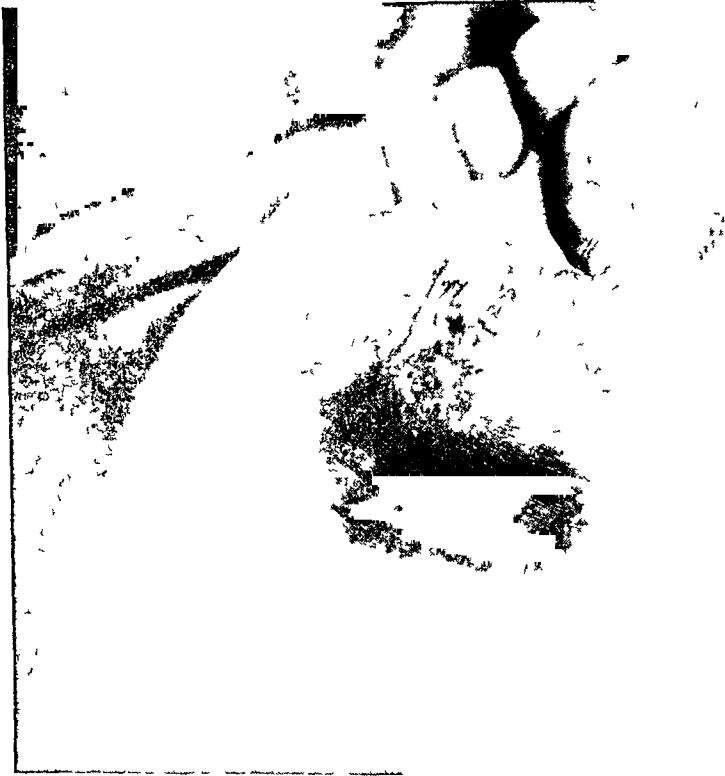
Tumor shown in Fig 11 in cross section Shows mottling of pigmented and pigment free areas

FIG 13



Mass removed by block dissection of Scarpa's triangle and Hunter's canal in a case of melanoblastoma

FIG 14



Small melanoblastoma of the ball of the foot

FIG 15

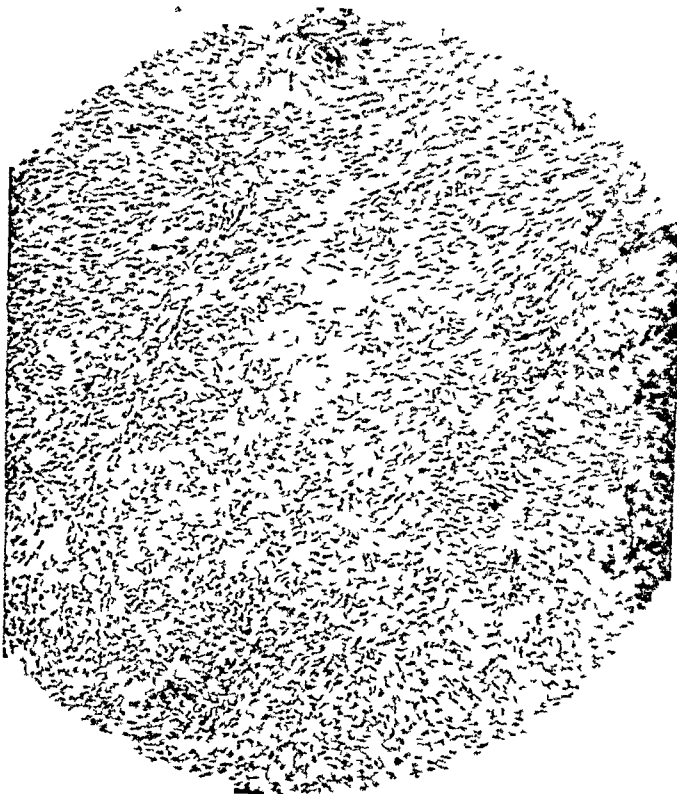


Photomicrograph of a section from a melanoblastoma of the sole of the foot The typical alveolar arrangement of the cells is shown



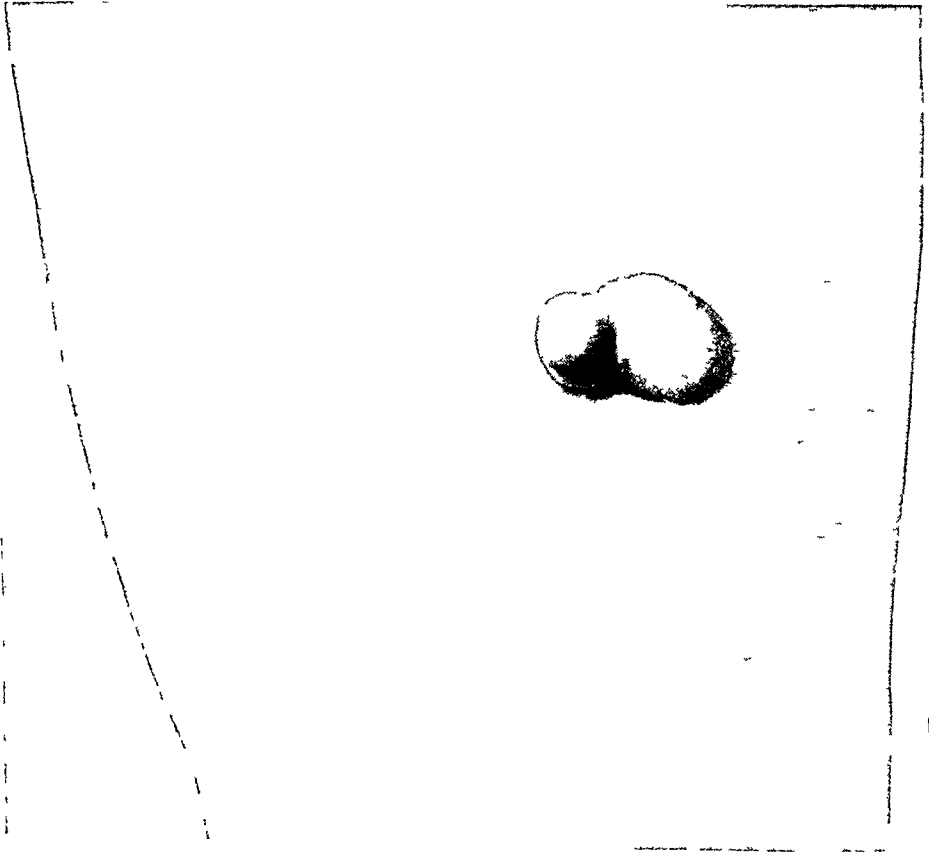
Photomicrograph of a beginning melanoblastoma of the sole of the foot The pigment cells lie between the elongated epidermal columns

FIG 17



Photomicrograph from a section of a lymph-node in a case of melanoblastoma of the sole of the foot The relative abundance of fibrous tissue appears

FIG 18



Melanoblastoma of the lower part of the thigh The nodule at the left represents a recent growth

The local recurrence on the lower part of the calf still retained some semblance of an alveolar arrangement

CASE X —Male, aged fifty-two Patient of Dr W W Duke Six months ago following irritation from a nail in his shoe, the patient noticed a small ulcer on the sole of his foot (Fig 14) over the metatarsophalangeal joint At the time of examination it had attained a diameter of 1 cm It presented a pale red granular mass free from the border of the skin but about flush with the surrounding epidermis Two months ago the glands of the groin began to enlarge and at the time of examination were 2 to 4 cm in diameter, the mass of glands extending from the groin to the promontory of the sacrum A section removed from the edge of the primary tumor by Dr Frank Hall showed the typical alveolar arrangement described in Case I Neither the primary tumor nor the metastasis gave evidence of pigmentation, but the colorless urine became pigmented upon the addition of oxidizing agents This test was made by Dr Duke and confirmed by Dr J P Kanoky The latter noted a marked increase in the pigment after the metastatic nodules had been X-rayed

CASE XI —An excised specimen removed from the sole of the foot was presented to me for study by Dr Frank Hall It was an ulcer 2 x 3 cm in diameter and presented the typical granular arrangement free from the border of the skin The portion nearest the epidermal border was pigmented The structure was alveolar with reticulated cell columns much resembling endothelioma

The variations in these cases are not so great as to conceal their essential similarity in course and structure The disposition to form ulcerating or fungoid growths, to recur locally and to form secondary masses in the lymph-vessels and nodes has already been mentioned As a rule tumors which ulcerate contain little pigment, though there was one notable exception in our cases Case III was free from pigment in the centre but had a border of pigment about the periphery Case IV was intensely pigmented in part and in part was pigment free Fig 5 presents a pigmented appearance and is just beginning to extend above the surface Cases VI and VII, which are likewise definitely pigmented, are appended to show the difference in these tumors when they occur above the plantar surface Several which have been observed on the dorsum of the foot presented an appearance similar to Cases VI and VII, which appears to indicate that situation has an affect in modifying the clinical behavior

The structure of these tumors is fundamentally pseudo-alveolar

(Fig 15) They appear to originate in isolated collections of cells beneath the epidermis (Fig 16) The early changes in the development of these tumors are identical with the early changes in the pigmented warts which so often give rise to malignant metastasis in neighboring lymph-glands They differ from these in a more extensive local growth and a more delayed metastasis, but like them, extension is by way of the lymphatics and the metastases may or may not be pigmented Corresponding to the general structure of moles in which the less pigmented areas are flatter, these tumors are less likely to be fungoid where they are free from pigment

The fact that these tumors either contain pigment or are closely related to those which do, furnishes the clue to their classification

Ribbert¹ has shown that the pigmented tumors, the melanomas, are derived from the chromatophores These are cells which lie beneath the epidermis, particularly along blood-vessels Their specific function is the formation of pigment Often, however, they do not exercise their function but lie dormant as colorless cells These colorless cells may give rise to tumors which differ from melanotic tumors in only one respect—they do not contain pigment

The eye is preeminently the seat of melanotic tumors In this region pigment-free tumors are sometimes observed which differ in no wise, either in structure or clinical course, from those which contain pigment These have been collected by Schieck² under the term leucosarcoma

The chromatophore cells are derived from the mesoblastic layer Ribbert (*loc*) states that they are as deserving of separate classification as the endothelial cells The chromatophores differ structurally from connective tissue cells in their larger, more granular nuclei and more abundant protoplasm which often extends between neighboring cells by long processes

The process of pigment formation is not thoroughly understood but the views presented by Meirowsky³ embody the latest work upon the subject According to him the chromatophores contain the enzyme which by oxidation of certain aromatic substances gives rise to the pigment Neuberg⁴ produced melanin artificially by adding adrenalin to a colorless extract of melanoma

That the elements for the production of melanin are present in the amelanotic tumors is indicated in Case X This tumor showed no evidence of melanin and, furthermore, it was of a type from which pigment is usually absent Yet the urine of this patient was tested for pigment independently by Drs Duke and Kanoky and gave a positive reaction

It would seem from this that even in the amelanotic tumors a substance is produced which needs only oxidation in order to become pigmented

The close relation of the tumors to the chromatophores is well shown in their structure. Those which develop upon congenital pigmented tumors show a more alveolar arrangement and in general the spheroidal, more primitive type of cells is maintained. Even these cells, however, often become elongated. In the tumors without apparent congenital basis which presumably have developed from mature chromatophores, the tendency to elongation is much more noticeable. This is true whether the tumor is pigmented or not, for it is the type of cell rather than its pigment content that determines the malignancy of the tumor. In beginning tumors it is often easy to follow the transition between types of cells. The primary tumor cells are more nearly spherical while those farther from the point of origin are more spindle-shaped. The prevailing arrangement of the more primitive cells is pseudo-alveolar. This arrangement is often retained when the cells become lengthened. Ribbert (*l c*) suggests very justly that the shape of the cell cannot be determined by the observation of cut sections only, but that teased specimens of fresh tissue must be studied in order to appreciate the length of the protoplasmic processes. This method, it may be noted, is often an aid in differentiating the tumor cells from the overlying epidermis.

The foregoing is sufficient to suggest that the tumors of this group are genetically identical. Even more emphatically does their clinical course indicate the same thing. They resemble in every characteristic melanomas in other situations. Both the pigmented and the non-pigmented types find their counterpart in like tumors of the eye. The topographic relations of the tissues from which they spring cause certain modifications which, however, need not cause any confusion. In both there is the same tendency to late metastasis. Those which develop from pigmented spots upon the scalp and arm resemble still more closely those of the foot, in that they metastasize in the regional lymphatics and relentlessly recur. The occurrence of the amelanotic type upon the arm or scalp has not been established. Perhaps it is the trauma to which the sole of the foot is subjected which tends to stimulate the chromatophores to multiplication. Several of the recorded cases and Case X of our own indicate the truth of this. I observed one case of a light brown papilloma of the forehead which when injured gave rise to pigment-free metastases in the cervical lymph-glands.

The question of the relation of these tumors to epithelial tumors is well answered by the metastases and recurrences. In these the cells

become more fusiform and in some instances nearly pure fibrous tumors result (Fig. 17) With each recurrence the deviation is further away from any resemblance to epithelial cells

To classify these tumors with the sarcomas seems unwarranted They are derived from specially modified connective tissue cells which because of their assumption of a specific function are entitled to separate classification Their disposition to metastasize by way of the lymphatics shows them to be different from sarcomas They differ as much from the typical sarcomas as do the endotheliomas In the more embryonal type there is in fact an approach to the sarcomas in that while they primarily involve the regional lymphatics, they soon pass beyond these and disseminate diffusely in the blood stream This is quite in accord with the preceding argument for identity of the melanomas The less differentiation from the connective-tissue cell the chromatophores have undergone the more closely the resultant tumors would be expected to resemble the embryonal connective-tissue tumors—the sarcomas

To Ribbert (*l c*) likewise we owe an escape from the perplexities of nomenclature The pigment-free choroidal tumors have been called leucosarcoma In the group of tumors under discussion, in order to designate the pigment-free varieties one would be obliged to adopt the cumbersome name of amelanotic melanomas Ribbert classifies them as chromatophoromas, an awkward but accurate term Mallory in his recent work accomplishes the same result by a less radical departure from familiar nomenclature He adopts the term melanoblastoma, which is equally as comprehensive as Ribbert's term and has the advantage of greater euphony

The adoption of a group name for all pigmented tumors has the advantage of not placing any special emphasis upon benign and malignant forms In these tumors a distinction along this line is particularly difficult, because the transition is gradual and not clearly indicated externally In considering them, therefore, there is particular need of accurate judgment of individual tumors They should be classed together under a name which expresses their common origin rather than any peculiarity of behavior

In addition to the cases above recorded we have been able to find the following in the literature

I BIRKETT* Small ulcer on sole of foot which began a year and a half ago as a hard lump under the surface of the skin Six months ago glands in the groin began to enlarge and the leg became œdematous Numerous nodules appeared on the surface of the body At postmortem the lumbar glands were found to be enlarged The lungs and liver were free

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II DURET⁶ reports a case which he believed was sarcoma, but which in one region was carcinomatous

III POLAILLON⁷ F, twenty-seven An ulcerated pigmented tumor which was movable on the underlying tissue Nodules of the same nature extended along the lymphatics and there were enlarged glands in the inguinal region At autopsy the cerebrum contained many nodules but other viscera were free

IV MURRY⁸ F, forty-six The patient felt a small growth beneath the skin of the heel a year ago Later this broke through the skin and appeared as a fungoid growth the size of a raspberry This was removed by an elliptical excision New nodules appeared near the site of the excision and were removed but were in turn followed by a new crop of nodules The foot was amputated above the ankle four months later One year later nodules appeared all over the surface of the body This author has seen a few other cases and recurrence always took place whether amputation was done or not

V YERSIN⁹ F, sixty-three A year before operation a black spot on the sole of the left foot, which had remained unchanged for over forty years, began to grow When examined it was the size of a hazel-nut, prominent and surrounded by secondary nodules There were also two black nodules on the dorsum pedis The epidermis was thinned but unbroken Finger-like processes extended downward from the Malpighian layer about and between the nodules The tumor was composed of intersecting bundles of ovoid cells with ovoid nuclei Some of the cells contained pigment granules

VI JESSETT¹⁰ F, forty-two Two years ago the patient injured her foot by a nail projecting from the sole of the shoe A sinus which discharged clear fluid remained Gradually granulations appeared, which were scraped away and the surface cauterized Healing took place in two months but the scar broke down and gave place to new granulations Six months later a fungoid mass the size of a shilling and $\frac{1}{4}$ in in height had developed This was again destroyed Four months later a large fungoid mass had appeared and Chopart's amputation was done There were no enlarged glands in the popliteal space or groin The microscopic diagnosis was alveolar sarcoma

VII REHN¹¹ Infant A tumor as large as half a walnut appeared on the dorsum pedis It was covered by a thin skin but the bluish-red tumor was apparent beneath It was incised by the family doctor and a large fungoid mass rapidly developed The foot was amputated and the patient recovered The microscopic diagnosis (Weigert) was sarcoma

VIII MERMET¹² M, fifty-two A painless, hard nodule appeared at the external malleolus after an injury Two years later the growth was irregularly pigmented The tumor was more firm in consistency than ordinary sarcoma Several lentil-sized tumors appeared in the neighborhood of the main tumor and in the inguinal region Local removal of tumor and inguinal glands The microscopic diagnosis was melanotic alveolar sarcoma of Billroth

IX NASSE¹³ M A pigmented sarcoma of the foot The author could trace, after amputation, beginning metastases along the dorsal vein

X STEINER¹⁴ Numerous tumors of various sizes appeared upon the sole of the foot, apparently developed from a small nodule which had been present since childhood The smaller nodules felt hard but the larger ones had grown through the skin, were covered only by a thin epidermis and were compressible

One nodule excised for examination was declared to be a carcinoma but was said to resemble closely the multiple pigment sarcoma of Koposi. The whole sole of the foot was removed and the defect covered by a transplant. There was no return two years later.

XI CAUBET¹⁴ F, fifty-eight. Injured foot by nail in shoe three years before. An ulcer was excised four months after the injury. Six months later an ulcer reappeared and soon gave place to a prominent tumor. The popliteal and inguinal lymph-glands were not enlarged. The growth was removed by local excision. The microscopic diagnosis was "sarcoma globo-cellulare."

XII MORESTIN¹⁰ M, forty-eight. The patient, a negro, had noticed for eighteen years a papilloma on the sole of his foot, which began to grow a year before he came under observation. The tumor when examined measured 8 x 9 cm, was bosselated and deeply pigmented. Near it was a separate nodule as large as a bean. It was not painful. There were no palpable glands in the popliteal space, but a dense mobile mass in the groin. The leg was amputated and Scarpa's triangle was cleared out. The microscopic diagnosis was spindle-celled melanoma.

XIII MARCHAND¹⁷ F, sixty. The patient first noticed a pigmented spot on the sole of the foot. At the time of death, which occurred from lung embolism, the tumor was 4.5 x 3 cm and had overhanging edges. It was dense and deep black in color. At the base of the toe was a group of black nodules. From this point to the dorsum were a number of varicose strands which appeared blue and resembled skin veins. In the inside of the right calf were many deep black nodules and on the inside of the thigh many small ones. When the skin was raised from the dorsum of the foot the varicose strands mentioned above appeared as irregularly distended lymphatics 5 to 8 mm in diameter. These lymphatics could be followed along the calf and thigh to the inguinal glands. The thigh veins were filled with brown-red thrombi but were free from tumor masses. The thoracic duct was not affected nor was there any visceral metastasis indicative of blood-vessel involvement. Microscopic diagnosis, melanocarcinoma. The cells were epithelial-like, more or less pigmented, with pale nuclei and large nucleoli. The connective tissue enclosed masses of cells which united to form systems which likely corresponded to the lymph vessels.

XIV GAUCHER ET ABRAMI¹⁸ F, thirty-seven. Two years ago the patient observed a pigmented spot on the sole of the foot. It remained stationary 18 months, and then enlarged rapidly for three months. It was diagnosed melanoma. It was 1½ in in diameter and was mobile, but the skin about it was slightly infiltrated. The surface was not ulcerated but was finely granular. The treatment recommended was the thermocautery followed by fulguration.

In the discussion of this case Gaston stated that the X-ray in these cases gives deplorable results, inasmuch as a local cure results but gland metastasis takes place. Hallopeau remarked that in all the cases he had seen the glands were involved. Lenglet stated that melanotic tumors are more diffusely spread than is apparent. Even in wide excision cells may be found distributed throughout the muscle.

XV LANDOIS¹⁹ F, thirty-two. A papillary tumor of the dorsum pedis which developed in two years. Histologically it was a naevus formed of nerves and chromatophores.

XVI BONNET²⁰ F, seventy-two An ingrowing nail followed by proud flesh resulted in a tumor the size of a mandarin It was red for the most part but in some places was sepia black It was covered with a thin exudate but was not tender There were melanotic spots on the anterior surface of the leg, and a gland the size of a nut in the groin but none in the popliteal space The toe was amputated

In summarizing the evidence above collected it becomes apparent that a clinical picture of striking uniformity results The variations, which are slight, are found to be in harmony with the anatomic differences

Age—The disease is one of advanced age The case in the newborn, as reported by Rehn, was more vascular than the type Our Case IX was 17 at the true onset The initial lesion was not observed by us but the subsequent course has been typical, and in spite of strenuous surgery will probably continue so

Sex—In the cases reported in the present paper males preponderate, but this proportion does not seem to be borne out by the reported cases, which are mostly in women

Duration—In a few cases there had been a lesion previous to the tumor, in one of ours as long as 8 years In the case of Steiner 20 years had elapsed From the beginning of active growth until the inguinal glands become involved, from 6 months to 2 years ordinarily elapse, and until termination of the disease usually from 2 to 6 years

Dissemination—These tumors spread by way of the lymphatics In a few instances only has a diffuse dissemination occurred Nasse (*lc*) stated that in his case the veins of the dorsum of the foot were involved Marchand's (*lc*) description is so clear on this point that one cannot but believe that in Nasse's case as well the veins he describes were pigment-filled lymphatics The great viscera which are the usual site of blood-vessel metastasis are singularly free in this affection Judging from the usually widespread lymphatic involvement it is strange that central metastasis by the thoracic duct is not more frequent

Local Recurrences—The disposition to local recurrence is striking This is explained by the mode of growth Long processes extend into the clefts between fibrous tissue bundles and probably into the lymphatics, as Marchand suggests Lenglet emphasizes particularly the disposition of these tumors to extend far beyond their apparent border Those which appear as projecting sessile tumors with a thin epidermal covering are more nearly circumscribed than the ulcerating type, as one might expect from their histological structure

Physical Appearance—The variability of the physical appearance

is in striking contrast to the clinical similarity. In form they vary from small excoriated ulcers not unlike any indolent ulceration to large angry-looking, fungoid, pigmented masses. The variability in form is, however, not essential. They are all tumors which arise in the dermic or subdermic tissue and push through their covering, the difference in form depending upon whether or not they just destroy the skin or project above it. The characteristic portion lies beneath the skin, not above it.

Diagnosis—To determine whether or not a mole has taken on malignancy is not always easy. If the growth has been stationary and presents no local change it may, with a certain reservation, be regarded as benign. However, in a case of papilloma of the scalp (*Treatise on Tumors*, Lea and Febiger, Fig 145, p 254) there was no evidence of irritation, yet a chain of melanotic glands was found in the temple and neck. Any reaction in the papilloma should suggest malignant change, and if growth has taken place at one point of the tumor or in its vicinity malignancy is certain. (Fig 18 represents beginning malignancy in a melanotic wart of the thigh.)

Congenital angiomelanotic tumors of the foot are sometimes seen, (Rehn's case) which take on the character more of angiomas than of melanomas even if one admit that they do actually contain pigment. There are as yet not sufficient data to permit one to separate them from the group under discussion. Adequate histological study of such cases has not been recorded.

Those which have taken on a fungoid growth and are pigmented, particularly when associated with enlarged glands in the groin, make a picture that is unmistakable. The smooth, deep red granular points looking through a punched-out aperture is very characteristic. The surrounding skin is sometimes irregular if the granulations project beyond the surface. If the granulations project through the skin beyond the general border of the skin defect the diagnosis is unmistakable. The lymph-glands are hard and usually discrete. The popliteal glands escape for the reason presumably that the deep lymphatics drain into them while the superficial vessels drain into the inguinal alone, which are, as a rule, the glands first affected.

Differential Diagnosis—Our first case was mistaken on the first visit for a perforating ulcer. The chronic painless course of the latter, together with the fact that it occurs most frequently in advanced years—in 95 cases in 136 it occurred after the fortieth year (Mirapeix)—makes it easy to mistake for a beginning malignant tumor. In our case, there was a distinct anæsthesia of the foot, the patient having had

an alcoholic neuritis which tended to warrant a snap diagnosis. Perforating ulcer is dependent upon neuropathic conditions of which alcoholic neuritis is one of the most frequent. In addition to this may be mentioned tabes, general paralysis, syringomyelia and traumatism. Diabetes also is said to be a frequent cause. The importance of these etiological factors should not be overlooked, but inasmuch as they may only complicate the diagnosis, as in our case, the chief reliance must be placed in the appearance of the ulcer itself. The perforating ulcer when deep enough to involve tendon and bone is recognizable at a glance. When it is in the process of healing the floor may be covered with sluggish granulations which are continuous with the surrounding epidermis, not projecting from it, as in melanoma.

Prognosis—These tumors must be reckoned among the most fatal, but in some of the very early cases cure may be possible. They have not in all cases been accorded intelligent treatment but it is a question whether any treatment can be of avail. Very early diagnosis is absolutely essential. Unfortunately when they reach the surgeon they have usually already been subjected to local irritation which has but stimulated their growth.

Treatment—Theoretically at least local treatment would cure them if done very early. Yet there is never any assurance that the tumor is strictly localized. One must assume, in fact, that the superficial set of lymph-glands in the groin are already involved. They should therefore be excised in all cases. The danger of elephantiasis of the leg following a too free removal of glands is to be kept in mind. The deep set of lymph-nodes will not be involved in the early cases.

The question as to wide local excision or amputation is likewise unsettled. In early cases local excision should, theoretically, suffice, but there is nothing in literature to justify such a procedure. On the other hand, if dissemination has already taken place, amputation will avail nothing. The patient may as well in that event use his foot during the small span of life still remaining to him. The fungoid type should give a better prognosis than the ulcerous and should give more encouragement to radical operation. When glands along the iliac vessels are involved any operation is useless.

REFERENCES

- ¹ Ribbert Beitr. z. Path. Anat., 1897, xxi, 471, also Geschwulstlehre, p. 255, Cohen, Bonn, 1904.
- ² Schieck Melanosarkom als einzige Sarkomform des Uvealtrakts, p. 111, Bergmann, Wiesbaden, 1906.

- ³ Meirrowsky Über den Ursprung des melanotischen Pigment der Haut und des Auges, Kleinhardt, Leipzig, 1908
- ⁴ Neuberg Virchow's Arch, 1908, cxcii, 521
- ⁵ Birkett Guy's Hosp Rep, London, 1857, 3s, iii, 331
- ⁶ Duret Arch de Physiologie, 1873, iv, 319
- ⁷ Polailon Union Med, Paris, 1880, 3s, xxx, 583
- ⁸ Murry Edinburgh Med Jour, 1881-1882, xxvii, 726
- ⁹ Yersin Arch de Physiol Norm et Path, Paris, 1886, 3s, vii, 421-425
- ¹⁰ Jessett Illustrated Med News, 1889, ii, 101
- ¹¹ Rehn Verhandl der deutsch Gesellsch f Chir, 1890, xix, 121
- ¹² Mermet Bull Soc Anat de Paris, 1895, lxx, 509
- ¹³ Nasse Erkrankungen des Fusses, Deutsche Chir, Lief 66, p 161, Enke, Stuttgart, 1897
- ¹⁴ Steiner Verh d deutsch Chir Cong, 1901, xxx, 1, 189
- ¹⁵ Caubet Bull et Mem de Soc Anat, 1903, lxxviii, 135-139
- ¹⁶ Morestin Bull et Mem Soc de Anat de Paris, 1905-6, lxxx, 520
- ¹⁷ Marchand Muench Med Woch, 1907, liv, 1704
- ¹⁸ Gaucher et Abram Bull Soc franc de dermat et Syph, Paris, 1908, xix, 188
- ¹⁹ Landois Zentralbl f Chir, 1910, xxxvii, 606
- ²⁰ Bonnet Lyon Med, 1911, cxvii, 366

TRANSACTIONS

OF THE

AMERICAN SURGICAL ASSOCIATION.

Annual Meeting Held in New York City, April 9, 10, and 11, 1914

The President, DR WILLIAM J MAYO, in the Chair

PRESIDENT'S ADDRESS

THE PROPHYLAXIS OF CANCER

THE President, DR WILLIAM J MAYO, delivered an address entitled, The Prophylaxis of Cancer, for which see page 805 of the June ANNALS OF SURGERY

SOME PROBLEMS IN THE EARLY DIAGNOSIS AND TREATMENT OF SARCOMA OF THE LONG BONES

DR WILLIAM B COLEY (New York City) submitted the results of 121 cases coming under personal observation. Of the cases in which the mixed toxin treatment was used either before amputation in the hope of saving the limb, or immediately thereafter in the hope of preventing recurrence, 19 have remained well for from 3 to 15 years. In the cases in which the toxins were not used 4 have remained well for over three years. Attention is called to the extreme malignancy of sarcoma of the long bones, especially of periosteal sarcoma. Of the older statistics quoted by Butlin nearly a generation ago, in 143 cases of periosteal sarcoma of the long bones, only one remained well after three years from date of operation. In all these cases most radical operation was performed,—high amputation, and in femur cases, at the hip-joint. The most recent and very valuable statistics published were in the discussion before the Royal Society of Medicine in London two years ago on Sarcoma of the Long Bones. Of 106 cases observed in the last decade at St Thomas's Hospital in London, 53 were suffering from periosteal sarcoma, and only one of these remained well three years after operation. Of the total number of cases, including the central or myeloid type, only ten were alive and well three years after operation. The preliminary use of the mixed toxins has, however, resulted in

the saving of the limb in 9 cases in my own experience. Combining this with the experience of other men the toxins have proved successful in about 20 cases. The results of this series of cases I believe establish beyond reasonable doubt the advantages of the preliminary use of the toxins before sacrificing the limb, and, after operation, as a prophylactic against recurrence.

Early diagnosis requires accurate clinical knowledge of all the conditions most likely to simulate sarcoma, and, also a great amount of actual examination and careful clinical study of a large number of cases of sarcoma of the long bones. The tactile sense is of inestimable diagnostic value. While the X-ray may often be misleading in the early stages of sarcoma of the long bones, it may also be of valuable help in making early diagnosis, and large experience in interpreting the X-ray is required. In periosteal sarcoma there are lesions that closely simulate sarcoma, especially in the non-ossifying type. Tuberculosis, syphilis and chronic osteitis may simulate this condition and here the X-ray is of very great help. In such cases the tendency of new bone to form spicules which stand out or radiate at right angles to the shaft of the bone is regarded by many authorities as characteristic of sarcoma. Personally, however, I have observed many important exceptions to this rule. The advantages and disadvantages of exploratory operation and microscopical examination of the specimen removed are discussed at length. With the history and clinical signs strongly positive I would not subject the patient to the risk of an exploratory operation, but would immediately perform the operation indicated. Upon two such occasions I did total excision of the clavicle for a rapidly growing periosteal tumor of only three weeks' duration. Another group of cases in which I would not do an exploratory operation is that in which, though the clinical evidence be less strong, the anatomical location of the tumor might render probable severe hemorrhage, and a sinus, difficult to heal. Exploratory operation is indicated in cases of sarcoma of the upper end of the tibia or lower end of the radius in which it is most important to know the type of tumor being dealt with. The exploratory operation is also indicated in periosteal sarcoma of both the shaft and the extremities of the long bones, especially in the early stages. The chief requirements for the early diagnosis of sarcoma of the long bones may be summarized as follows:

- 1 A more careful study of all known clinical data
- 2 A large clinical experience in the diagnosis of sarcoma of the long bones

3 Early X-ray examinations in all suspected swellings of the long bones, especially those following trauma

4 Exploratory operation and microscopical examination of the tissue removed in selected cases, but *not* as a routine measure

5 The importance of not placing implicit reliance upon the negative report of the pathologist, especially when in conflict with clinical and X-ray evidence that is strongly positive

DR CHARLES A. PORTER (Boston) reported that in a case of sarcoma of the upper lumbar vertebra in a boy of nineteen, the condition at operation was found to be typical giant-cell sarcoma. Curetting would have been ineffective. There was free bleeding and the wound was packed. Large doses of the Coley toxins were given and the boy is perfectly well one year and a half since operation.

DR JOHN H. GIBBON (Philadelphia) had had one case of periosteal spindle-cell sarcoma in a girl of seventeen, prompt recurrence after incomplete operation, refusal of shoulder-joint amputation. She was then given the toxins and X-rays. It has now been five years with absolutely no evidence of recurrence. The woman has since married and borne a child. In another case his assistant at the Pennsylvania Hospital, Dr. Allen, operated for a recurrent spindle-cell sarcoma of the forearm. Prompt recurrence taking place the patient was put on the toxins and X-ray treatment. The growth melted under it, and at present, 8 or 9 months since the treatment was started, there is no evidence of recurrence.

DR THOMAS W. HUNTINGTON (San Francisco) said that he was able to report two satisfactory cases treated with the Coley toxins. In each case he began with infinitesimal doses, in one case after extirpation of the clavicle. While the objection may be made that the operation cured the patient, it has now been six or seven years since treatment, which extended over six months, and there has been no recurrence. The second case was a large spindle-cell sarcoma following in six months the kick of a horse in the muscles of the right thigh. The tumor was removed by the physician in the country but it immediately returned. Dr. Huntington then did an extensive operation and placed the patient upon infinitesimal doses of the toxins, increasing these to the point of tolerance. The patient has now been well for about a year, and reports that in every respect his condition is satisfactory.

DR ARCHIBALD MACLAREN (St. Paul, Minn.) said that his partner, Dr. T. deWitt, had obtained his own toxins from a case of erysipelas and, using them, obtained a real result. In one case of partial removal of a spindle-cell sarcoma of the parotid treated by the toxins there was

recurrence inside of a year Under the toxins the growth entirely disappeared There was again a return which disappeared after an ordinary attack of typhoid fever In five years the woman died with general sarcomatosis, so that the original condition must have been sarcoma There is no question that the growth disappeared after typhoid fever, nor is there any question of its complete disappearance under the administration of the toxins

DR HOWARD LILIENTHAL (New York) had used the toxins regularly and consistently and had had fewer recurrences than he thought possible

DR WILLIAM L RODMAN (Philadelphia) had had no case of recovery after the use of the toxins for lesions in the long bones, yet had had cases in which the condition was improved after the use of the toxins when the lesions were in the throat and in one case in the parotid gland The most marked case he had ever seen of benefit or relief was a patient of Dr Kuhn of Louisville Dr Kuhn had operated five or six times on a young man of twenty, the growth promptly returning after each operation The toxins were then resorted to, with the result that the young man is now a practicing physician and is well in every way The condition occurred 16 years ago In another case of sarcoma of the parotid who had undergone two operations, and who now declined the third operation, the toxins were used with complete disappearance of the growth He had seen many other cases operated on in which he thought, that had the treatment been persistently carried out complete cure would have resulted He had not seen any good results from the use of the toxins in carcinoma

DR N B CARSON (St Louis) said that in a patient seen many years ago with a tumor under the clavicle with a diagnosis of sarcoma a second operation was refused They then used the Coley toxins and the tumor gradually disappeared He was able to follow the patient for a number of years after the injections and there was no return when last heard of In another case in the practice of a colleague the whole lower abdomen was filled with what was taken to be a sarcoma Under the use of Coley toxins the tumor gradually disappeared and the patient was well three years after treatment He had at present the care of a young doctor who had a sarcoma of the humerus operated on when first seen and which recurred The infection had involved the shoulder He did a second operation and since had been using the Coley toxins On the anniversary of the operation the patient writes that he is perfectly well and doing a large practice Dr Carson had sometimes used the toxins in sarcoma without success, and, frequently, in carcinoma with no success whatever

DR WILLY MEYER (New York City) said the point mentioned by many speakers of the Coley toxins having no effect in carcinoma is substantiated in his own observation, neither has it any effect in endothelioma. It had been his peculiar misfortune to have two patients with small tumors on the back simulating atheroma. In one case which he operated the condition was endothelioma. In another case the patient had at the same time a scirrhus of the breast. In these cases the toxins had no effect. In another case of sarcoma of the chest there were all the typical symptoms of tumor in the anterior mediastinum, compression of veins, etc. The patient, a doctor, insisted upon thoracotomy. He was first referred to Dr. Coley, but became discouraged because of fever and chills attending the serum treatment and again asked for operation. Again he was persuaded to continue the toxin treatment. Now this patient writes that he is so much better that he wants to continue the treatment at his own home. There is no doubt that sarcoma, and inoperable sarcoma particularly, needs the Coley toxins besides the X-ray treatment.

DR STANLEY STILLMAN (San Francisco) reported that in a case of sarcoma of the chest wall, attributed to the irritation produced by leaning over a boat in fishing, the tumor entirely disappeared upon the Coley toxins. The man, however, had mediastinal metastasis and died just as he was thought to be getting well, the parent growth entirely disappeared. It is important to remember in connection with Dr. Coley's paper that periosteal sarcomata are rarely recovered from. In his own experience, the cases amputated or disarticulated without the use of the Coley toxins died generally within one year. After amputation the use of the toxins may produce recovery.

DR CHARLES H. PECK (New York City) added the report of one case of incompletely removed sarcoma of the submaxillary region operated upon five years ago, which was treated afterwards with the Coley toxins and was followed by a complete cure. He had used the toxins in a number of cases but this is the only one with beneficial results.

DR JOHN B. MURPHY (Chicago) said that we are indebted to Dr. Coley for keeping alive an element of hope. In the history of sarcoma we find many things influencing cases positively sarcomatous to recovery. Dr. Coley has kept to a system, and that system shows that something produces a change in the cells. We have learned from Abderhalden that the protoplasm of each individual cell produces an enzyme and that enzyme has a specific inhibiting effect in the blood. That seemed to him to be the line in which Dr. Coley's work for so many years had directed us, and in which we should have hope.

DR ARTHUR DEAN BEVAN (Chicago) said that he was prepared to accept the fact that in the course of thousands of cases a limited small number, which if all of the cases were taken into consideration, amount to a considerable number but small percentage, have been influenced by the use of toxins. In 75 or 100 cases he had never seen a cure from the use of the toxins in either carcinoma or sarcoma. He had seen marked effects and continued to use the toxins in inoperable cases. In his experience the X-ray had been of very much more benefit in both inoperable carcinoma and sarcoma than the toxins. He believed both should be employed, but with the emphasis upon the toxins, they simply give a possibility, not any great assurance of benefit.

THE TWO-STAGE OPERATION ESPECIALLY IN ITS RELATION TO TREATMENT OF CANCER

DR GEORGE W. CRILE (Cleveland, O.) read a paper with the above title, for which see page 57.

DR FRED B. LUND (Boston) had employed the two-stage operation in ulcer and cancer of the stomach only in cases in which the patient was very weak. In cases in which there is doubt of the diagnosis of cancer he would be more inclined to use the two-stage method than in those in which he was sure of cancer, because not only may cancer progress during the waiting stage, but it may be more extensive than anticipated, and the adhesions from the previous gastro-enterostomy may hamper a thorough operation at the second stage. In cases in which resection is easy, the patient in good condition, he should never think of the two-stage operation in undoubted cancer of the stomach.

DR JAMES E. MOORE (Minneapolis) had for a long time been a firm advocate of the two-stage operation in selected cases. He knew of no more satisfactory procedure than, with enlarged prostate and infected bladder where ether anaesthesia would be fatal, under a local anaesthetic, to make a small incision suprapubically and drain the bladder. He was also in accord with Dr. Crile in reference to appendectomies. There is a strong tendency to undertake too much and to interfere with some of the undertakings of the Almighty. Many times had he opened a large abscess and, not being able to find the appendix without ripping things up, had left it, had the patient recover, did a second operation followed again by recovery.

DR HOWARD LILIENTHAL (New York) said it is now five years since he emphasized in a paper published in the ANNALS OF SURGERY in 1910 what he thought was the importance of the two-stage operation in resection of the pylorus. Since then he had concluded that the

TWO-STAGE OPERATION FOR CANCER

method is even more valuable than he at first thought. In gastric ulcer cases particularly it is of importance. Some years ago he undertook a two-stage pylorotomy in which a large tumor the size of a duck's egg disappeared in two weeks. He let the patient go and he came back with a recrudescence undergoing carcinomatous change. He operated on him and he got well. By making a median incision, or even a left-sided incision for the gastro-enterostomy, by examining the pylorus with great gentleness, using no gauze or other packing, there will be no adhesions at the time of the second operation.

DR ARPAD G GERSTER (New York) said there is not a doubt that the two-stage operation, where indicated by special conditions, is a very useful expedient, but, the argument advanced by Dr Moore, that in appendicitis we are doing too much and thus interfering with the designs of the Lord, might be applied to all surgery, which is all an interference with the designs of the Lord. There is a great difference between doing a two-stage operation where necessary, and doing it under all circumstances. The broad application of this principle as a routine is entirely unnecessary. If ever he himself had to be operated on he would be willing to run a little additional risk in order to get through at one clip. An extended experience in surgery demonstrates that in the majority of all major cases the two-stage operation is unnecessary. We ought to diminish the anguish and suffering to which the patient is subjected by an unnecessary operation. Further, it would hamper the hospital surgeon to a tremendous extent when ten or fifteen patients must be operated upon in three or four hours.

DR FREDERIC KAMMERER (New York), with regard to the two-stage operation in tumors of the pylorus, said we have all done a gastro-enterostomy for such tumors in cases in which the tumors have disappeared, being purely inflammatory in type. He has done the secondary operation in three cases in which no tumor remained. His experience in carcinoma differs from that of Dr Lilienthal, for after a gastro-enterostomy at the first stage, he had found the removal of the tumor at the second stage much complicated. It is his belief, especially when it is considered that these patients, although with low hæmoglobin count, will stand an operation remarkably well, that it is better and easier to do a resection and gastro-enterostomy at one time.

DR ALEXANDER PRIMROSE (Toronto) said that while Dr Crile had shown us that the two-stage operation has a very valuable application, he quite agreed with Dr Gerster that it should not be the routine method of procedure. For example, Dr Crile spoke of the value of drainage of loops of gangrenous bowel. Here he would take issue with him under

certain conditions, and in illustration would refer to volvulus high up in the small bowel where the gangrenous area existed within some twelve inches of the duodenojejunal juncture, there the excision of the bowel was made, or rather, drainage with partial excision because no further operation could be done, and we had here the further difficulty of nutrition to contend with. We were compelled to do a second operation in twelve days, and the condition of adhesions was such that the operation was exceedingly difficult and the patient succumbed. We could have possibly saved this life if we could have performed immediate operation in the first stage. Another case of volvulus of the small intestine occurring at a lower point was mentioned by him in which the bowel was gangrenous. Resection and anastomosis were followed by recovery. He would also take issue in acute appendicitis. The gangrenous and septic appendix is a source of great danger and should be removed if at all possible to get it out. His experience is that there is also danger of spreading infection along the lymphatics with resulting subphrenic abscess when the appendix is left in and the abscess drained.

SYSTEMIC BLASTOMYCOSIS

DR CHARLES A. POWERS (Denver) read a paper with the above title, for which see page 815, June ANNALS OF SURGERY.

DR ARTHUR D. BEVAN (Chicago) said that these cases are more frequent than is generally recognized. The Germans for a long time doubted the existence of this lesion, but it is quite as definite as syphilis or tuberculosis. Treatment rests upon the use of potassium iodide plus the X-ray, and by this treatment nearly all local cases are curable. So far none of the systemic cases under the observation of Dr. Ormsby and himself have gone on to recovery.

DR N. B. CARSON (St. Louis) said sometime ago we seemed to have an epidemic of blastomycosis in St. Louis and two or three of the cases were of the systemic type, all of which died. They seemed to tolerate drugs very badly. We tried varying forms of treatment and in the local cases with very good results.

DR EMMET RIXFORD (San Francisco) said there is some little confusion on this subject in the minds of some of the speakers. The term blastomycosis is given to this disease which Dr. Powers has reported. The organism is very different from the blastomyces, that is, the fungus which multiplies by budding. The cases mentioned by Dr. Bevan were cases of true blastomycosis. The disease reported by Dr. Powers is entirely limited to California and to a single valley—San Joaquin valley. The first case was found by himself in 1894. Dr. Gilchrist confirmed the

RÉSUMÉ OF RONTGENOLOGICAL DIAGNOSIS

observations as to the character of the organisms which he thought were coccidia Dr Stiles, of Washington, to whom the material was then submitted, gave the name coccidiodes Shortly thereafter they found a second case in which the organism was distinctly different as were also the clinical manifestations The organism in this second case was much larger There was high fever, great depression, and death occurred within six weeks of the first manifestation of the lesion In the first case which lasted two years, nothing did any good except vigorous local surgical procedures Before the man died his face, eyes and mouth were destroyed There were lesions in his bones and at autopsy his lungs were found to be completely consolidated with innumerable white tubercles about the size of oldish miliary tubercles The adrenals were as large as duck eggs and consolidated with caseous material

THE VALUE OF GLUZINSKI'S TEST IN THE DIAGNOSIS OF GASTRIC ULCER

DR JOHAN NICOLAYSEN (Christiana, Norway) read a paper with the above title, for which see page 821 (June)

RÉSUMÉ OF THE RONTGENOLOGICAL DIAGNOSIS OF SURGICAL LESIONS OF THE STOMACH AND DUODENUM

In this paper DR GEORGE EMERSON BREWER and DR LEWIS GREGORY COLE (New York City) presented the results obtained in the study of 50 or 60 rontgenograms of one patient in various postures, taken in several series at intervals of two hours until the stomach was empty They have perfected a true rontgenocinematographic machine, capable of making 50 rontgenograms of a single cycle, or 200 rontgenograms of an individual peristaltic contraction from the fundus to the pylorus The information gained by such an examination includes Size, position and shape or type of the stomach, activity of peristalsis and width of peristaltic contractions, character of the systole and diastole, depth of the rugæ and the direction in which they run, degree of dilatation and the motor phenomena of the descending and horizontal duodenum, character of the pyloric sphincter and of the cap (pilleus ventriculi)

The interpretation of findings has been worked out by a study of about 20,000 rontgenograms of 680 cases A report on 27 consecutive cases examined rontgenographically by Dr Cole and operated upon by Dr Brewer shows the accuracy of the method

The clinical history, physical examination and gastric analysis were unknown to the rontgenologist. In the evidence furnished by this series of 27 cases we find that of the 21 cases definitely diagnosed by the Rontgen method, subsequent operation proved that 20 were correctly diagnosed and one incorrectly. In 10 of these cases the diagnosis was negative regarding the presence of a gastric or duodenal lesion, although the clinical history was so strongly suggestive of ulcer or carcinoma as to justify exploratory incision. In not one of these cases was there found an organic lesion. In the 6 instances in which the rontgenologic diagnosis was not definitely stated, the opinion expressed was correct in 4 instances and incorrect in 2. In other words, in this particular series, a correct diagnosis was made by serial rontgenography in 89 per cent of the cases. The objections to the method are that it requires considerable time and is moderately expensive. In the opinion of the writers, however, serial rontgenography will give more accurate information concerning lesions of the stomach and duodenum than any other method employed at present. The paper in full will appear later in the ANNALS OF SURGERY.

A FURTHER REPORT ON PYLORECTOMY OR EXCISION OF THE ULCER-BEARING AREA

DR WILLIAM L. RODMAN (Philadelphia) said if ulcers are situated at or near the pylorus, as they are in about 80 per cent of all cases, and the pyloric end of the stomach and proximal portion of the duodenum can be easily mobilized, pylorectomy, which gets rid of the present ulcers and prevents future ones to a large extent, removing as it does four-fifths of the ulcer-bearing area, is certainly the operation of choice. The frequency with which hemorrhage, perforation, and cancer, especially the latter, follow after gastro-enterostomy renders it inadequate.

If, however, the converse obtains, the stomach and duodenum being bound down by adhesions to adjacent viscera, such as the pancreas, liver, gall-bladder, transverse colon, etc., simple gastro-enterostomy, the anastomosis being made about the middle of the stomach or preferably to its left, should be practised. If the symptoms are not relieved within a reasonable time, then pylorectomy may be performed.

The operation can also be done in two stages in those patients not in good condition, whether it be from hemorrhage, perforation, anæsthetic or other cause. It is often best to perform pylorectomy for cancer in two stages, and practically the same conditions may confront the surgeon in ulcer, but it will be much less frequently the case.

Gastric ulcers, duodenal as well, are more frequently multiple than is appreciated, some excellent authorities state that such is usually the case. All potential dangers are increased with the number and chronicity of ulcers, hence, radical measures are more urgently called for in both varieties.

Ulcers away from the pyloric end, that is, occupying the expanded four-fifths of the stomach, should be preferably treated by partial gastrectomy or removal of the ulcerated area. Although such ulcers rarely undergo cancerization, they frequently bleed and perforate, both of which dangers are increased by the freer movements of this portion of the stomach during respiration, and the further fact that protective adhesions are less apt to form if we except the lesser curvature, which is relatively immobile. If excision is practicable it should be done, as it carries with it a smaller mortality than gastro-enterostomy—175 per cent.

In some cases it may be wise, though not as a rule, to supplement excision by gastrojejunostomy. Usually the one operation is sufficient.

A METHOD OF SURGICAL GASTRECTOMY

DR FRANCIS T STEWART read this paper, for which see page 828 (June)

CHRONIC PANCREATITIS

DR JOHN B DEAVER (Philadelphia) read this paper, for which see page 841 (June)

SUGGESTIONS REGARDING THE ANATOMY OF, AND THE SURGICAL TECHNIC IN, THE TREATMENT OF JONNESCO'S MEMBRANE

DR JOHN E SUMMERS (Omaha) said that the Jonnesco-Jackson-Reid membranes should be considered as congenital. They may always be demonstrated in every individual should the incision admit. They are purposive and intended by nature as ligamentary supports preventive of intestinal stasis rather than causative, and if this is so, they should be divided only after they may have become restrictive of intestinal function from loss of nervous and muscular tone resulting from chronic intestinal toxæmia. The so-called 'white line' is the line of fusion of the duodenal and colonic peritoneum with the parietal peritoneum after rotation has been completed, and can be made manifest by rotating the attached hollow viscus in a direction continuous with the course of the blood-vessels and fibres of the membrane, a direction opposite to the fetal rotation. The "white line" may be called the ligamentary attach-

ment of the pericolic membrane to the parietal peritoneum. The viscera of men differ in as great a degree as do their faces,—there are no two exactly alike. The Jonnesco-Jackson membranes are the cause of intestinal stasis only when their support is defective, or where it may be excessive and cause angulation. These membranes, although present in children, seldom produce symptoms in them, because intestinal peristalsis is sufficiently powerful in children to overcome minor difficulties. I have never observed symptoms of these membranes in anyone under seventeen years of age. Most of the sufferers are from thirty to sixty years of age. Intestinal stasis can be caused independently of any angulating bands or ptoses, as it has been clinically proved to be caused by an incompetency of the ileocolic valve in a large number of people,—250 out of 1500 examinations—and the condition remedied by an operation correcting this incompetency. The X-ray study of the alimentary tract is of invaluable service in locating the cause of obstruction in obstinate cases. Very many sufferers from stasis due to ptoses of the hollow viscera are best relieved by mechanical supports.

THE ILEOCOLIC VALVE AS A FACTOR IN CHRONIC INTESTINAL STASIS, OPERATIVE TREATMENT

By DR EDWARD MARTIN (Philadelphia) read this paper

DR GEORGE E ARMSTRONG (Montreal) remarked that Keith of the Royal College of Surgery in London is inclined to regard the ileocolic valve rather as a sphincter than as a valve, and some of the X-rays in the London Hospital have tended to show that normally there is a stenosis at the lower end of the ileum, and the large number of lymphatic nodes situated in this region would seem to be another evidence that there is normally stenosis with a more than usual amount of absorption. Examination of a series of cases has determined that while, as a rule, there seems to be a constitutional stenosis at the lower end of the ileum just before it enters the cæcum, it is not always true that the taking of food stimulates the emptying of the cæcum. It is quite possible that this valve may be designed, to a certain extent, to delay the emptying of the ileum, and may also have a valve action to prevent the back flow of the content of the colon loaded with bacteria where bacterial digestion goes on normally from receding into the lower end of the ileum.

DR JABEZ N JACKSON (Kansas City) said that when he first presented this subject in 1908 most surgeons said there was no such thing. Now it is said to be a congenital condition in everybody. Although he had seen a considerable number, he was still in doubt as to its etiology.

When one makes an effort to demonstrate a pericolic membrane when there are no symptoms to warrant it, and pulls up the lax colon on the outside until the veins are put taut, he will have a rapid engorgement of the parietal peritoneum which will be called pericolic membrane, which, however, shows no interference with the mobility or action of the colon. Under no circumstances would he consider that to be Jackson's membrane, unless it can be positively demonstrated to be producing mechanical interference with the gut, and becomes the subject of surgical discussion, just as a tendon becomes surgical when producing a contracture. With the presence of this contracture and obstruction there are associated clinical symptoms and evidence is also afforded by the X-ray. Regarding treatment of this pericolic membrane, there are two distinct factors that can be absolutely demonstrated,—the presence of constriction and, following this, the presence of obstruction. Removal of the obstruction is not sufficient, and he had combined the idea of the Germans of plicating the cæcum and removing the membrane without removal of the gut.

LIGATION OF THE INNOMINATE ARTERY FOR SUBCLAVIAN ANEURISM

DR C A HAMANN (Cleveland) reported a recent successful case, for the full record of which see page 962 (June)

ON THE TECHNIC OF INTRATHORACIC OPERATIONS

DR ALEXIS CARREL (New York) said that the report of intrathoracic operations by American and European surgeons shows that pleurisy is still a frequent complication. In the experimental operations performed lately by him, this complication was completely avoided. This result was obtained by attention to a few technical details which prevented the irritation and infection of the pleura. Through a small opening a silk membrane is introduced into the pleural cavity. Afterwards two large compresses, made of a sheet of absorbent cotton and two sheets of black Japanese silk, are introduced into the pleural cavity and used for walling off the operating field. The pleura is never seen by the operator or touched by his fingers. This will protect against the germs of the air and the blood from the operating field is absorbed by the cotton inside the compresses. This simple procedure seems to play a large part in the results obtained by the writer.

EXPERIMENTAL OPERATIONS ON THE ORIFICES OF THE HEART

DR ALEXIS CARREL (New York) read this paper, for which see page 1

DISTANT RESULTS OF A SUTURE OF THE HEART FOLLOWING A WOUND BY PISTOL-SHOT

DR ROBERT PROUST (Paris, France) read this paper, for which see page 968 (June)

THE SURGICAL TREATMENT OF AORTIC ANEURISM

PROF DR H KUMMELL (Hamburg) said the surgical treatment of the aneurism of the aorta may be indirect or direct To the first group belongs the ligature of the subclavian and carotid arteries and the introduction of a spiral wire, the light scratching of the wall with a fine needle, the laying around of a thin aluminum band as Gatsch and others did, stripes cut out of the aorta of the animal on trial as was done by Halsted To the direct surgical class belongs folding the wall of the aneurism as Matas and Allen did Tuffier has, after the resection of the left thoracic wall, pinched the sack of the aneurism of the aorta thoracica by pressure forceps and closed with a double suture of Carrel The speaker had had the opportunity to seize directly an already burst aneurism of the thoracic aorta No similar case can be found in the literature A man, fifty-two years of age, had been infected with lues three years before Some months ago he came to the medical part of the hospital in Hamburg with an aneurism of the aorta The patient left the hospital after some time improved in health and looks He returned shortly after, looking suddenly reduced and with strange pains in a pulsating tumor of the left side The patient was thin, complained of severe pains and shortness of breath, occasioned by an immense, prominent tumor going from the left pelvis over the left rib Aneurism of the aorta could not be diagnosed even after a radiographic picture An effort was made to free the aorta above and below the burst sac, resect the five ribs near to the spine, setting free the aorta extrapleural without injuring the pleura Compression of the aorta by the hand of an assistant Extension of the cut downwards, setting free and clearing the sac of the aorta filled with thick bloody masses and which was already burst To better overlook the operation field the cut was lengthened downward through the diaphragm, retroperitoneal, so that the whole aneurismal sac above and below could be perfectly overlooked From the aneurismal sac we took so much away that a nearly normal lumen was obtained and the 10 cm wide opening closed by a suture After taking off the digital pressure still a little bit of blood appeared A second suture was made then and bleeding stopped Circulation in both lower extremities was entirely restored and normal When the

wound was closed the pulse of the patient was comparatively good. He died later of weakness of the heart on account of the reduced state of his health.

AURICULAR FIBRILLATION FROM TRAUMATISM OCCURRING IN A HEART PREVIOUSLY NORMAL

DR. GEORGE E. ARMSTRONG (Montreal) read this paper, for which see page 852 (June).

THE INTERPLEURAL EXPOSURE OF THE HEART BY MEANS OF LONGITUDINAL SECTION OF THE STERNUM

PROFESSOR REHN (Frankfort, Germany) remarked that infection of the pleura is the most important factor in the mortality of heart wounds, the next most important is the bleeding during the operation.

The method. By the following method of operation for heart wounds the greatest safety, that the pleura remains unopened during operation is secured. It also makes possible immediately controlling the bleeding from the heart in that we can reach both venæ cavæ and lessen the supply to the heart as desired. In operating the incision is made from the left second chondrosternal articulation to the middle of the xiphoid process, then it follows the left costal arch, the latter incision is deepened, rectus and transversalis abdominis are cut, and the incision continued along the under surface of the costal arch and the sternum above. The finger easily separates the delicate fibres of the diaphragm and enters the mediastinum. The xiphoid process is now either pushed aside or removed. A well-rounded saline sponge is pushed up into the mediastinum. This pad now pushes the pleura out of the way on both sides and insures the safe splitting of the sternum up to the third or even second chondrosternal articulation. The divided sternum is then forcibly held back by hooks and the pleura protected by gauze. When necessary the pleural folds are retracted by means of the gauze. Care must be taken not to attempt to retract the pleura with the fingers, as it is easily perforated. If the thorax is very rigid, the sternum must be divided transversely. The anterior surface of the pericardium is now freely exposed and one can open it as far as desired. The heart is just as easily accessible and the incision offers us an especially good opportunity to compress the venæ cavæ. After completing the operation the breast-plate section can be readjusted by several bone sutures. The pericardium should be closed by interrupted sutures which should not be taken too closely together so that any fluid exudate can escape between the sutures. The mediastinal space must be drained and this in the absence

of air (elimination of air by the negative pressure in the mediastinum) The space is walled off after a few days, when emphysema of the mediastinum is no longer to be feared He had now used this method six times with satisfaction He would consider it applicable if a complicating wound in the thorax subsequently required a wide opening in the pleura

DR FRANCIS T STEWART (Philadelphia) mentioned, in connection with Dr Kummell's paper, a case of aortorrhaphy The patient was suffering from vegetative endocarditis and had an embolus lodged at the bifurcation of the abdominal aorta There was beginning gangrene of the right leg and symptoms of gangrene in the left The abdomen was opened, the posterior parietal peritoneum split, the aorta compressed between the fingers of an assistant and the embolus dislodged without difficulty This was several days after impaction of the embolus, and aside from the successful suturing of the vessel is of importance in showing that the embolus was not adherent The pulse was reestablished in the lower extremity, but the patient died four days after operation from œdema of the lungs as a consequence of the cardiac condition

In connection with Dr Armstrong's paper he spoke of a patient with a bullet lodged in the fat about the base of the aorta within the pericardium He operated with the idea that there was a heart wound and found the pericardium moderately filled with fluid, removed the bullet, did not drain the pericardium and the patient recovered At the last meeting of the American Surgical Association he reported five cases of suture of the heart Three recovered At that time he said that those who were still living showed no evidence of cardiac degeneration These patients had not been examined as carefully as Dr Proust's patients X-rays have not been made and the electrocardiogram has not been used One patient, apparently well, died at the end of five years Autopsy showed what Professor Proust pointed out ought to occur, pericardial adhesions, and in that patient, the descending branch of the left coronary artery had been tied at the operation In the area supplied by this artery there was a marked interstitial myocarditis with dilatation, not so great as to justify the diagnosis of aneurism, but marked thinning and dilatation

DR WILLY MEYER (New York) said that from what he had seen experimentally he felt that the future of this subject lies in intrathoracic surgery, and not in splitting the sternum In aneurism of the aorta, it is due to Dr Lusk, who has followed the method of introducing a special wire into the aneurism and treating with electrolysis, that we

at this time consider this the best method. The degree of success attendant upon this method does not mean that we have reached the end in treatment. All experiments should be continued and the future will show more radical methods.

DR HOWARD LILIENTHAL (New York) called attention to the fact that splitting of the sternum may be followed by the accident of auricular fibrillation. He had a case not long ago in which he split the sternum by the Sauerbruch method down from above and then, carefully separating the two halves, removed a large retrosternal growth. The possibility of this accident should not be overlooked. One of his colleagues found that no case was reported in which auricular fibrillation had been actually observed upon the heart itself in the human subject. Dr. Armstrong is quite right in saying that he is the first to show this pathologic phenomenon.

PROFESSOR CHARLES HENSCHEN (Zurich) said that for saccular aneurisms of the thoracic aorta in which Tuffier advocated the simple occlusion ligature, the Matas procedure is an analogous operation. In the fusiform aneurisms of the thoracic aorta he had attempted experimentally the strengthening of the vessel wall by operation in two ways. In one of these the aorta, in segments, is strengthened from without by broad bands consisting of flaps of fascia sewed around it. Our attempts show that these cuffs of fascia make possible an easily healing, mechanically excellent reinforcement of the vessel wall. In the second method tubes of absorbable material (of galatholith) of a calibre corresponding to that of the aorta, and in any case corresponding to the lumen below the damaged area of the vessel, are inserted through a longitudinal cut in the wall of the aorta into the lumen extending through the whole aneurismal portion. In these inserted tubes oval openings are made to correspond to the origin of the more important vessels in order to permit the free passage of blood. At the lower end of the galatholith tube is bored a circle of round holes which permit the fixation of the tubes by means of interrupted sutures penetrating through the wall of the aorta. Perhaps a combination of the outer fascial wall reinforcement and the tube method is more to the purpose, although both are in the experimental stage.

DR HARVEY CUSHING (Boston) said that some years ago in Baltimore experiments were undertaken in operations upon the cardiac valves. These were done in a very much more crude manner than the methods employed by Dr. Carrel. The lesions were made by introducing into the heart, either into the apex or into the larger vessels, knife hooks by which the valves could be divided, and it is extraordinary how

simple these measures actually are The character of the lesion was determined by the application over the valve of a phonendoscope, so one could tell by the murmur when the lesion desired was brought out These experiments were chiefly useful in serving as subjects for the class in cardiac studies of physical diagnosis They were able to accomplish satisfactorily only the insufficiencies of the four valves, the experimental stenoses were much more difficult to produce With Dr Carrel's method, doubtless, stenosis by suturing of the valves in direct apposition can be produced Recently a patient in the Brigham Hospital with a severe mitral insufficiency, and who finally came in with a complete decompensation, had suddenly in the ward an embolism of the right femoral artery, lodging just at the bifurcation of the profunda femoris The man had a dry gangrene of the lower extremity up to the knee Amputation was performed and not long after he succumbed to his cardiac lesion At autopsy nothing was found in the heart, except the familiar button-like slit of the mitral valve If one could only have put, as was done experimentally, a little knife hook into the apex of the heart, the man's difficult stenosis could have been transferred into an insufficiency, and he at least would have been much better off so far as the function of his heart was concerned Does Dr Carrell feel that, although these things are possible upon the normal heart, when disease is present there is any chance that one may be able to clamp the root of the heart or be able to carry out some of these more serious operations?

CHOICE OF ANÆSTHETIC FOR DRAINING FOR ABSCESS OF THE LUNG

DR FRED T MURPHY (St Louis) read this paper, for which see page 36

CASES OF LUNG ABSCESS AT THE MASSACHUSETTS GENERAL HOSPITAL

DR CHARLES L SCUDDER (Boston) reported a total of 27 cases operated upon There were 9 deaths, 18 recoveries, 11 cases without cough or sputum at varying times following operation, 8 cases were well 12 years, 5 years, 4 years, 8 years, 1 year, 1 year, 6 months, 6 months, respectively, after operation The remaining three cases have not been followed long enough to be sure of the result This series illustrates the variety of the etiological factors concerned Pneumonia with the influenza bacillus, embolism, actinomycosis and subdiaphragmatic infections were the chief causes The necessity for the early recognition of bronchiectasis is emphasized that the surgeon may have the opportunity of removing the affected lobe before terminal con-

ditions become established The value of the X-ray is also emphasized The operation of draining a lung abscess is best done in two stages unless the lung is adherent to the chest wall

SURGICAL INTERVENTION IN CASES OF PULMONARY INFECTIONS

PROFESSOR ANTOINE DEPAGE (Brussels) said that the results of Forlanini's method for lung tuberculosis are most favorable in cases in which one lung only is affected and in which there are no pleural adhesions Forlanini's treatment is rather medical than surgical We are pleased to state that this medical treatment is based on a surgical principle Artificial pneumothorax as created through this method acts as follows

1. In allowing the affected organ to rest, while the movement of normal respiration would prevent healing

- 2 In allowing the walls of the cavity to fall together, thus emptying themselves of pus It diminishes the absorption of toxins and the increase of bacteria It allows a better healing of the ulcerated surfaces, on account of their proximity

- 3 It is favorable to sclerosis of the pulmonary organs because it diminishes the blood and lymphatic circulation and produces irritation by the introduction of nitrogen in the pleura (Castaigne).

The question of whether there would not be reasons to make wider applications of Forlanini's method, not limited to tuberculosis, was brought to my mind by the following case In 1900 I had a case of infectious pneumonia which seemed as though it would be fatal on account of intoxication The patient was a healthy woman of twenty-seven, the right lung only was affected, temperature 39.3°C With the resection of two ribs and widely opening the right pleura relief came rapidly and the patient recovered Unilateral pneumonia may cause death by acute intoxication before the second lung becomes inflamed At this moment I would not propose to resect the ribs as in the above case, but I believe that Forlanini's method would be indicated The collapsed lung is put at rest, it is no longer disturbed by respiratory movements, its circulation is far less active than when the lung is in normal inspiration A collapsed lung can be compared to a member lightly compressed by a bandage, and this without allowing the intra-pleural pressure to be greater than the atmospheric pressure, simply by the fact of elastic retraction of the organ In suppressing the respiratory movements and in diminishing the quantity of blood circulating through the organism, the chances of absorption of toxins which are the causes of immediate danger are reduced

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PULMONARY ABSCESS AND BRONCHIECTASIS, A CLINICAL REPORT

DR HOWARD LILIENTHAL (New York) read this paper, for which see page 855 (June)

THE SURGICAL ASPECTS OF BRONCHIECTASIS

DR JAMES G MUMFORD and DR SAMUEL ROBINSON (Clifton Springs, N Y) presented this paper, for which see page 29

THE PRESENT AND FUTURE IN THE SURGICAL TREATMENT OF TUBERCULOSIS OF THE LUNGS AND BRONCHIECTASIS

PROFESSOR C HENSCHEN (Zurich) said that severe and moderate cases of unilateral tuberculosis of the lungs, cavernous as well as infiltrated, namely those with pronounced tendency to shrinkage, can through lung collapse and compression become cured clinically and anatomically. Every treatment of collapse must begin with an attempt at artificial pneumothorax, if the latter is impracticable on account of adhesions, then extrapleural thoracoplasty is indicated, with which in the clinic in Zurich, out of 122 cases 20 per cent were clinically cured, 34.6 per cent considerably improved, and 26 per cent improved. In certain selected cases extrapleural pneumolysis and plugging also give favorable results.

Among the bronchiectatics, the peripheral types with soft walls, principally those of post-pneumonic and post-empyemic origin may be treated by expansion and compression measures (thoracoplasty, pulmonary ligature, intrapleural resection, *verlagerung*, after Garre, extrapleural pneumolysis with plugging). Cases with primary disease of the bronchial wall or lesions situated centrally, around the hilum or with thick walls, remain uninfluenced by this treatment. In the future a cure may be attained by working out the most practical compression method, *verlagerung* of the lower lobe under the diaphragm after Henschen, in circumscribed bronchiectasis of the lower lobe or through radical removal of the entire diseased lobe of the lung.

ON BRONCHIECTASIS

DR WILLY MEYER (New York) read this paper, for which see page 7

DR GERARDO M BALBONI (Boston) said that his experience with artificial pneumothorax is based upon 61 cases treated during the last

three years, 57 were cases of pulmonary tuberculosis, four were non-tuberculous. There were 2 lung abscesses and 2 cases of bronchiectasis. The experience with these four non-tuberculous cases is pertinent to this discussion. One lung case and one abscess case may be regarded as cured, the other two as improved. The puncture method was used in all these cases. The chief dangers associated with this method of treatment are pleural shock, gas embolism, spontaneous pneumothorax from rupture of the lung and rupture of the mediastinum. It is best to produce the pneumothorax gradually by frequently bringing it to the desired volume and pressure. It is uninterrupted for the entire period of treatment. Anatomical healing.

The manometer may show respiratory oscillations. Negative, even oscillations, and positive. It is very difficult to allow the lung to expand prematurely. The time that has elapsed varies with each individual case depending on the extent of the lesions. It is necessary to keep the patient at least a year. When the patient has been free of symptoms for six months we may allow gradual re-expansion. With return of symptoms treatment should be immediately resumed. Frequent X-ray examinations are essential. The patient should have full knowledge that the treatment is long, tedious, troublesome and expensive and not without dangers.

DR JOHN B. MURPHY (Chicago) remarked that there is never with this method danger from pneumothorax if you recognize the conditions which can lead to produce a mortality. If you immobilize the mediastinum and fix the lung hilum you have no danger. Based upon personal observation in from 2300 to 2400 cases, he claimed that there is practically no danger from collapse of the lung. The series of cases presented to-day show that the chest can be opened and explored without special danger from pneumothorax if you immobilize the mediastinum. In his earlier work when he let the mediastinum vibrate on inspiration, the septum went from side to side and there was no respiratory exchange produced. In the human being, if one opens the chest wall and compresses the mediastinum to the opposite side, one can go on with the work. In one case in which he opened both thoracic cavities in removing the anterior wall of the chest for carcinoma, in taking off the left side of the sternum he opened the right pleura. He heard the whistle and compressed the opening with his finger, completed the operation, sutured it, put back the flap, and aspirated the side on which they operated to expand the lung.

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DR E. WYLLYS ANDREWS (Chicago) emphasized a point which had not been sufficiently brought out, *viz*, the want of any indication for any kind of lung replacement in unilateral chest operations. Negative pressure is superseded by positive pressure. Experimental surgery has shown us that opening one pleural cavity is without risk, and we can go further and say that the opening of one pleural cavity does not in all cases stop the function even of the lung on that side, resection of the chest wall does not necessarily collapse the lung. That the lung should have a positive expansive power does not seem reasonable, but it has. One who had seen a lung expand sufficiently with each respiration to thrust itself out into the outer air, will believe that not in all cases will the lung collapse. One may cut a wide opening in the chest and in the majority of instances, even should the lung collapse, no great harm is done.

DR FRANK E. BUNTS (Cleveland) agreed with Dr Andrews regarding the innocence of opening one side of the chest and performing almost any kind of operation necessary without artificial means of inflating the lung. His experience was confined to lung abscesses and the small intralobar abscesses which could be located only by the the clinician.

346 per cent. EMMET RIXFORD (San Francisco) thought not enough attention certain cases paid to the difference between unilateral open pneumothorax and bilateral open pneumothorax. His experience with inflation of the on the left side he had found difficulty in putting sufficient pressure on the heart, the trouble came from pressure on the heart. One can, however, make a partial, open pneumothorax by blocking the opening with a sheet of guttapercha tissue or a folded wet towel that can be slipped under the flap, and some resistance made to increase the egress of air. With the respiration and pulse approaching the danger point one would close the opening with the wet towel when the respiration and pulse would subside. After closing the opening with the flap the air is aspirated from the cavity and the respiratory function is satisfactorily restored.

DR FRED T. MURPHY (St. Louis) emphasized the importance of differentiating between the conditions in which the cavity is to be opened and in which it is not. In the acute abscesses it seemed to him that it is essential to fix the chest wall before drainage. It is distinctly essential to use intratracheal insufflation in the cases in which the exploration is extensive and the chest wall widely opened, and not to use a general anæsthetic.

DOUBLE AND ANOMALOUS FORMS OF EMPYEMA

PLEURAL AND PULMONARY COMPLICATIONS IN TROPICAL ABSCESS OF THE LIVER

DR JAMES E THOMPSON (Galveston, Texas) read this paper, for which see page 891 (June)

A paper entitled "Empyema," by DR JOSEPH RANSOHOFF, of Cincinnati, was read by title

DOUBLE AND ANOMALOUS FORMS OF EMPYEMA

DR KENNETH A J MACKENZIE (Portland, Ore) reported in detail four cases of double empyema occurring during an epidemic of influenza in the Northwest in the year 1899 In all cases either bilateral, simultaneous thoracotomy, or bilateral thoracotomy, with a few days interval between operations, was done Several interesting cases of anomalous forms of empyema are reported, including gunshot wounds, stab-wounds, putrid empyemata following aspiration, and one case in which the *Paragonimus Westermani* was the etiological factor Thirty fully reported cases of double empyema are collected from the literature, in all of which aspiration, incision and drainage, resection and drainage, or some combination of the three procedures was performed either simultaneously or at intervals varying from 1 to 150 days In one case simple bilateral aspiration effected a cure Including the fully and partially reported, 140 cases of double empyema are found in the literature with a total mortality of 37 or 27.14 per cent

The author concludes

- 1 That the inefficiency of aspiration alone considered, together with the danger of septicopyæmia, warrants a more thorough operation in all cases

2. The shock of an acute traumatic pneumothorax and the present mortality in the treatment of empyema makes the development of a better procedure desirable

A preliminary report of a very ingenious substitute for acute operative pneumothorax is submitted The plan is to replace the serous or purulent fluid of pleurisy or empyema by a non-toxic and non-absorbable fluid, such as petrolatum or liquid paraffin The technic of this procedure is given The method offers the advantage of relieving empyema without the shock of a traumatic pneumothorax The hydrocarbon will act as an inhibitor of bacterial growth By holding the surfaces apart until inflammation is allayed, dense adhesions are prevented The non-absorbable and non-toxic fluids may prevent progression to the purulent stage This procedure may be substituted for compression of the lung by nitrogen gas whenever such means are resorted to for the cure of tuberculosis

VISCERAL PLEURECTOMY FOR CHRONIC EMPYEMA

DR CHARLES H MAYO and DR E H BECKMAN (Rochester, Minn) presented this paper, for which see page 884 (June)

DR JOSEPH RANSOHOFF (Cincinnati) said that the thoracic cavity cannot be opened with the same ease and safety as the abdominal cavity, because of the actual shock accompanying the opening for such a small thing as aspiration. In my own service I know of two deaths upon the table from simple thoracotomy, deaths that occurred without premonition under general anæsthesia. There is no place in the whole anatomy where the use of a knife is more likely to be followed by shock than in the chest, and if anywhere anoci-association is indicated, it is here. It is highly essential that we should open the chest under local anæsthesia. One of the most admirable additions to our treatment of the simple cases is that of Hobben of not aspirating the fluid but of blowing it out. The last essayist alluded to an operation which I devised some seven or eight years ago,—discission of the pleura. It is an operation like so many others that one makes because he cannot continue with an operation that he originally set out to do. How to designate this modification of the DeLorme-Fowler puzzled me until I remembered the operation of the ophthalmologists known as discission.

DR FRED B LUND (Boston) remarked that in 1910 he reported seven cases of pleurectomy. Since that report he had been able to modify Dr Ransohoff's procedure by leaving on some little patches of pleura, and in favorable cases they will be long enough to suture part of the lung to the chest wall. In children, if you do an Estlander or Schede operation and take out all the ribs, you invite curvature of the spine, but if you can make the lung expand, you will find a straight back as the child grows. Local anæsthesia in ordinary empyema is very valuable. Where you trephine the rib and put in a small drain you will not obtain satisfactory results, nor even where you put in a large tube. There is needed a large hole for the pus to come out and a long lap to come down over it so that the air cannot get in. He had used the skin for this lap recently, making the incision in the skin over the rib below the rib you take out, suturing the top to the lower end of the incision, and the upper end is absolutely flush with the inside of the chest. Thick pus will lift up the lid and when the chest expands the air is prevented from getting in.

DR CHARLES N DOWD (New York) had resorted to pulmonary decortication in 24 cases. Among these cases he had to operate three at periods of several months or years after the original operation and he had been very much surprised to find how little lung remained for

TEMPOROMANDIBULAR ARTHROPLASTY

these patients. He thought the difficulties of the DeLorme and Schede operations had been magnified. One will find in each of these chests a sinus running to the apex of the chest from the cavity. If one carries the incision through the anterior axillary line, cuts one rib after another to the apex of the chest, and then cuts through the pulmonary pleura and strips it back, the patient will not suffer very much shock.

DR ALEXANDER PRIMROSE (Toronto) said that in the case of a man who came with a pyopneumothorax and extreme emaciation and discharge, he undertook to do an extensive Schede operation and succeeded in carrying him through, and he made a complete recovery and returned to his work as a motorman. He continued thus for two years, when he contracted pneumonia and died. At postmortem they found, as Dr Dowd stated of his cases, very little functioning lung on the operated side. It appeared to him that if after section of the visceral pleura these lungs are capable of expanding, then these individuals are in better condition to withstand such an illness as this patient had.

TEMPOROMANDIBULAR ARTHROPLASTY

DR JOHN B MURPHY (Chicago) said ankylosis of the jaw may be divided into (1) the intra-articular fibrous and osseous, and (2) the extra-articular cicatricial varieties. The most common type is the bony, and in this there is complete fixation of the jaw. When the ankylosis is fibrous there is some degree of motion in the jaw. The symptomatology is a flattening and deformity of the unaffected side, while the opposite side is full and round, a retraction of the chin with deviation toward the ankylosed side, and a slight sidling motion of the unaffected side on forced opening of the mouth. The muscles on the ankylosed side are more atrophied than those on the opposite side. The technic of the operation consists in the division of the mandible at its condyles, the removal of a third of an inch of the entire diameter, the interposition of the temporal fascia and fat flap, and closure of the wound. Then the separation of the teeth on the operated side by a block for two weeks and the institution of passive motion after the third week. The pedicled flap, consisting of the mucous membrane of the soft and hard palates, has rendered us excellent service in the inter-alveolar cicatricial type of contractions. We are reporting here only our most recent cases. Of the nine cases we have been able to trace eight. In seven the result has been ideal. In the eight, in which the coronoid process and the zygoma were involved, restriction of motion resulted.

PROFESSOR LEVER (Jena) believed that in ankylosis of the jaw the

tion In November, 1910, the author for the first time, in a favorable early cancer of the tongue, removed the right half of the tongue, the right floor of the mouth, the right half of the jaw and the glands on the right side of the neck, all in one piece The wound was closed by suturing the mucous membrane of the right cheek to the remaining half of the tongue The patient was able to swallow at once after operation, and no recurrence followed The microscopic study showed that the floor of the mouth was infiltrated, but the glands were not

As the removal of the lower jaw, especially at the symphysis, is mutilating, the author has attempted to accomplish the same results in a different way The glands of the neck are first removed, and after the operation, their connection with the floor of the mouth below the lesion is thoroughly burned with the cautery and the wound closed Then the lesion in the tongue and floor of the mouth is attacked with the electric cautery This is repeated two or more times until everything is destroyed down to the area of the first cauterization from below The healed skin flap of the first operation forms the floor of the mouth and prevents an oral fistula The first operation after this method was performed in April, 1912 The lesion was a cancer occupying the floor of the mouth between the tongue and the symphysis of the jaw It was about the size of a silver dollar Permanent cures have been accomplished in similar cases by *en bloc* dissection of the tongue, floor of the mouth, jaw and glands The oldest case thus treated lived fifteen years, but the operation is very mutilating and, recently, a patient refused to submit to it This led the author to attempt what he had had in mind for some years Now, two years since the operation, there is no evidence of recurrence and no mutilation Since then four other cases have received this treatment with, so far, apparent success

The majority of cases of cancer of the tongue seek surgical aid at an unnecessarily late period In every case the patient is warned—there is always something to be seen and felt in the tongue or floor of the mouth If such a lesion is investigated at once, a local operation with the electric cautery should be sufficient, in a later stage removal of the glands and repeated cauterizations of the mouth lesions, in still later stages, resection of the jaw must be done Recent experience seems to show that this operation should be done in stages first, thorough removal of the glands with cauterization of the floor of the mouth from the neck wound, second, cauterization of the lesion within the mouth, third, removal of the lower jaw and cauterized area Cases observed to 1908 compared with those of the past five years show the influence of education The very early precancerous lesions have in-

GASTRO-ENTEROSTOMY IN CASES OF PERMEABLE PYLORUS

creased from 8 to 30 per cent. The late and inoperable cases have decreased from 18 to 10 per cent. The cures have increased from 21 to 50 per cent.

In the 14 cases personally operated upon by these newer methods in the past five years, there has been no post-operative mortality, and so far but one patient is dead from recurrent carcinoma, and there is evidence of recurrence in only one case. Considering all the cases studied the post-operative mortality has been about 22 per cent. The results in the 14 cases also demonstrate that the improved methods promise a much larger percentage of permanent cures and a longer freedom from recurrence.

DR MORESTIN (Paris) said that the prognosis of cancer depends chiefly on the time of treatment and upon the methods employed. The complete extirpation of the menaced or invaded lymphatic channels and glands is absolutely necessary, as essential as the removal of the cancer, which should be done by cutting wide of the tumor mass. For instance, in the case of carcinoma of one side of the tongue, which is very common and quite typical, the part of the organ corresponding to the diseased section should be extirpated, as well as the floor of the mouth and all the subclavicular carotid and submaxillary glands and those glands lying below the hyoid bone. The carotid region should be carefully closed by sutures uniting its muscles,—the external wound should be completely closed, the buccosubmaxillary wound packed, and food given only through the stomach tube until cicatrization of these wounds. The patient should be allowed to get up on the day of the operation or on the following day.

THE FUNCTION OF THE GASTRO-ENTEROSTOMY OPENING IN CASES OF PERMEABLE PYLORUS

PROFESSOR HENRI HARTMANN (Paris France) read this paper, for which see page 832 (June)

DR J M T FINNEY (Baltimore) said that Professor Hartmann's observations were in entire accord with his own. It was never his practice to close the pylorus in doing gastro-enterostomy. It has never seemed to be necessary but once or twice. The more he studies X-ray in connection with stomach cases, the less dependence does he place upon it. If it agrees with the clinical picture it is accepted as corroborative evidence. The well-established idea that in the face of a closed pylorus the new opening will never close is not true. A case came under his notice recently, operated upon by Dr Gerster, which statement is sufficient evidence that the operation was well done in the beginning. A posterior gastro-enterostomy had been done in the face of an unob-

structed pylorus by scar tissue. The man came under his care with symptoms of almost complete obstruction. He operated and found the pylorus absolutely obliterated. The mucous membrane was completely restored. There was a natural closure of the pylorus after the opening made by Dr. Gerster, which opening functioned for about 5 years. For 4 or 5 months the obstructive symptoms increased and when he operated the new opening was not larger than a straw. This shows that it is possible for the new opening to close in the face of a closed pylorus.

DR. ARPAD G. GERSTER (New York) added to the interesting observation of Dr. Finney's the important item that the operation was done with the aid of the Murphy button, and the very observation given by Dr. Finney has been repeated to the speaker in a number of other cases operated on ten years ago and again six or seven years ago, when the Murphy button was more frequently used. When these apertures were inadequate, and when a peptic ulcer developed, as Dr. Hartmann suggests, along the juncture of stomach and jejunum, the inadequate aperture closes more promptly and rapidly than where an ample stoma is established.

DR. FRED B. LUND (Boston) said that in a case in which Dr. Weir did a gastro-enterostomy 10 years ago on a patient then aged sixty-three, for 10 years there was dilated stomach with visible peristalsis. Upon operation Dr. Lund found the stoma had closed to the size of a lead pencil. One-half of the intestinal button had gotten back into the stomach and stuck in the pylorus so that it was necessary to do a Finney operation, which has been most applicable in his hands where gastro-enterostomy has not been satisfactory. In another case, that of a woman upon whom he had done a gastro-enterostomy for extensive indurated ulcer of the lesser curvature four years previously, he found, upon undertaking to remove a fibroid, the pylorus and gastro-enterostomy wound both open. This goes to confirm Professor Hartmann's observations.

DR. JOHN BAPST BLAKE (Boston) said that in Professor Hartmann's valuable paper he spoke of the paper by Cannon in which Dr. Blake did the operative work on cats. In their conclusions they did not state that food would invariably pass out through the pylorus, but that the physiological tendency was that it would pass through the pylorus. They would, therefore, differ from the conclusions of Professor Hartmann, and say that the tendency is invariably to go through the pylorus if the pylorus is open. Their second observation agreed with Professor Hartmann's upon the inefficiency of a stoma placed in the cardiac end of the stomach.

TREATMENT OF MALIGNANT TUMORS BY RADIUM

EXTIRPATION OF THE SPLEEN FOR DISEASES OF THE BLOOD

DR RANZI (Vienna) said that about 20 extirpations of the spleen for diseases of the blood are reported, performed at the Surgical Clinic of Prof v Eiselsburg, Vienna. The indications for these operations made by Professor Eppinger were Hæmolytic icterus (3 cases), pernicious anæmia (5 cases), Banti's disease and hypertrophic cirrhosis of liver (9 cases), thrombophlebitic forms (3 cases).

From all these cases 4 patients died after the operation (shock, ileus of duodenum, 2 pneumonia). The results in the other 16 cases were very satisfactory. The patients, formerly very weak and obliged to keep their beds, have regained their strength and weight and are again able to work, especially the cases of pernicious anæmia. In pernicious anæmia the extirpation is very easy, in other cases sometimes very difficult, on account of the excessive adhesions and enlarged blood-vessels. The operations were performed under local anæsthesia.

DR. J M T FINNEY said that during the last year he had operated upon three cases,—two of the pernicious anæmia type and one of the Banti type. All have made excellent recoveries, and one case presented the interesting anomaly of a double spleen. The oldest patient had been kept alive for a year by repeated transfusions. For about a year now she has had a perfectly normal blood picture and, so far as one can tell, she is absolutely well. This patient belonged to the pernicious type. The other two patients have been operated upon so recently that it is impossible to say what the results will be, but the immediate results have been most satisfactory in all three cases.

THE TREATMENT OF MALIGNANT TUMORS BY RADIUM IN THE CLINIC OF VON EISELSBERG, VIENNA

DR RICHARD SPARMAN said that since July, 1913, 52 cases of inoperable malignant growths have been treated with radium at the Clinic of Professor v Eiselsberg in Vienna. We have 225 mg. radium and 150 mg. mesothorium at our disposal, divided in fifteen applicators. Malignant tumors have been exposed curatively or preventively following not radical operations. Preventively used, it seemed to hasten the recurrence in nearly all our cases. There is not such a thing as elective effect, the tumor cell is not more easily destroyed because of the specific action of the radium itself, but being a degenerative cell it is more susceptible to any trauma. The histological changes in the tissues are not specific. The effect of the radium is only a local one. The hopes we placed in the radium as a new and successful means in the treatment of malignant tumors have not been realized.

AMERICAN SURGICAL ASSOCIATION

RESULTS OF TREATMENT OF CYSTIC DISEASE OF THE BREAST

DR ROBERT B GREENOUGH and (by invitation) DR CHANNING C SIMMONS (Boston) read this paper, for which see page 42

BLEPHAROPLASTY BY A PRE-GRAFTED FLAP

DR CHARLES L GIBSON (New York) read a paper with the above title, for which see page 958 (June)

UNCOMPLICATED TUBERCULOUS FOCI IN BONES AND THEIR TREATMENT

DR THOMAS W HUNTINGTON (San Francisco) read this paper, for which see page 930 (June)

A REVIEW OF CASES OF FRACTURE OF THE PATELLA

DR H BEECKMAN DELATOUR (Brooklyn) read this paper, for which see page 975 (June)

FRONTAL SINUS SUPPURATION

DR HOWARD A LOTHROP (Boston) read this paper, for which see page 937 (June)

BOOK REVIEW

SURGERY OF THE UPPER ABDOMEN By JOHN B. DEWEY and A. P. C. ASHHURST Volume II. SURGERY OF THE GALL-BLADDER, LIVER, PANCREAS, AND SPLEEN Philadelphia P. Blakiston's Son & Company, 1914

IN 1909 the first volume of this excellent book was reviewed in "The ANNALS," the concluding statement being "The book is a notable contribution to one of the most important departments of modern surgery."

The lapse of four years before the appearance of the present volume is explained by the authors' desire to supplement their personal experience by familiarity with the voluminous literature bearing upon the surgery of the gall-bladder, liver, pancreas, and spleen.

It may be said at once that they have accomplished their task in a most thorough and satisfactory manner. If there is a single contribution to the subject entitled to be considered as of first importance which has escaped their notice, it has also escaped the notice of the reviewer. Evidence of their large personal experience is abundant. Statistics and bibliography are comprehensive, thorough, and well up to date. The four years have obviously not been wasted. The teachings throughout are sound, and the views of the authors are not dogmatically announced, but are supported in each instance by sound and usually convincing reasons. Illustrative cases, taken chiefly as are many of the statistics from the service at the German Hospital, add much to the value of the text. If any particular portions of the book were to be chosen for especially favorable mention, those on the gall-bladder and bile-ducts, and on the general diagnostic considerations in pancreatic disease, might be selected.

In the former, the teaching as to the treatment of stone in the common duct will serve to illustrate sufficiently the statement that there has been a successful effort to avoid both rashness and undue conservatism, and that a decent regard is shown for the opinion of others. They say "It has long been considered unwise to operate when there is acute obstruction of the common duct, it is the opinion of the majority of surgeons, in this country at least, that it is better to tide the patient over the attack under medical treatment than to

subject him to the danger of an operation when so acutely ill " They then consider the non-operative treatment during acute obstruction, and add " But though, as we have said, the majority of surgeons still hold to this teaching, we have been forced by our own experience to the conclusion that in the long run *immediate operation during an attack of acute obstruction of the common duct is attended by less danger than is delay* If operation is delayed the patient runs the risks of cholangitis, cholæmia, with the gravest form of sepsis, not to mention perforation of the common duct or the formation of almost inoperable adhesions, or the indefinite persistence of chronic jaundice with its dangerous hemorrhagic tendencies

" Our experience with immediate operation is so far too limited for us to be willing to erect this as a rule of practice, but while many times there has been cause to regret not operating during the stage of acute obstruction, never yet has there been cause to regret prompt relief of the obstruction by operation "

Many similar instances might be adduced, but this will suffice

The 52 illustrations are uniformly good and useful The make-up of the book is excellent The almost unqualifiedly favorable opinion expressed as to the first volume is certainly applicable to this one in even larger measure The authors and the profession are to be congratulated on the completion of a book likely, for a time at least, to be almost indispensable to the practitioner of surgery

J WILLIAM WHITE

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WAR SURGERY

THE PRESIDENT'S ADDRESS OPENING THE FOURTH CONGRESS OF THE INTERNATIONAL
SOCIETY OF SURGERY

BY PROF. DR. ANTOINE DE PAGE
OF BRUSSELS

At this opening of the Fourth Congress of the International Surgical Society, I am sure that your President may be permitted to delay the beginning of the scientific discussions for a short time, to salute the great American Nation in the name of all the members of the Congress.

The first three meetings of the International Surgical Society took place in Belgium—we gave the preference to a neutral country, so as to clearly define the scientific and, at the same time, fraternal character of our Association.

It is not necessary for me to tell you that it is the privilege of our little Belgium to offer a meeting place to the learned men of all nationalities, covered by Europe herself with the shield of peace and liberty.

How did we decide without hesitation to accept the cordial invitation of our American colleagues?

Such an important decision was not justified merely by the deep esteem we feel for your great surgeons, or by the most legitimate curiosity, it was influenced chiefly by the certainty that we should all receive a welcome prompted by the most noble sentiments of scientific fellowship. Belgium asserts her pacific tendencies by her political neutrality and by her industries, which can only prosper in times of peace, mighty America disposes otherwise: she favors the treaties by arbitration which are the triumph of right over might, she organizes her universities and her scientific institutions, which assure more and more the victory of intellect over force and chance.

The International Surgical Society in quitting the neutral soil of Belgium and in choosing New York as the seat of this meeting, shows the high esteem in which it holds our American colleagues, and at the same time the confidence it feels in the final triumph of the ideas

of peace and civilization, that the United States personify throughout the whole world

We surgeons necessarily represent by our profession itself a mute and constant protest against the evils of war, by organizing help for the wounded, and working during the periods of peace, to anticipate all the horrors of the battle-field, so as to be ready and waiting with our help

We impress upon all, that war is the greatest of scourges. When we give an account of battles, we do not enlarge upon the heroic side, although we are fully sensible of its grandeur, but rather discuss the consequences of war, we produce statistics, which present a formidable list of wounded, killed, mourning, sufferings and horrible mutilations

The surgery of war owes much to America, in 1861 you were surprised, so to say, by the Civil War, nothing had been prepared to sustain the gigantic struggle into which you were drawn, your medical service, as well as your army, was, so to say, in its infancy, then improvised soldiers started up throughout the length and breadth of your territory, and help for the wounded, organized by countless numbers of committees and of associations which acted in unison, thanks to the initiative of a man, that America may rank amongst her great citizens, Pastor Henry Bellows

The Sanitary Commission was acknowledged and established by President Lincoln under the name "Commission of Enquiry and Information for all that concerns the sanitary interest of the Union Armies"¹

The writers of the history of the War of Secession have described in glowing colors the noble part this Commission played in the course of events, it was, writes an eminent author, "the great artery, which carried the love of the American people to the army"²

Gentlemen, if I here refresh the glorious, but at the same time painful memory of these heroic times, it is that since fifty years new duties have arisen, with which it is of importance that the surgeons of all countries should reckon. The time has passed when the art of war was but a manifestation of exalted personal courage, the art of war has called science to its help, and the response has been a fearful perfecting of the means of destruction. At the same time in

¹ The United States Sanitary Commission

² *La médecine militaire en France et aux États-Unis*, par W Laboulaye, membre de l'Institut, 1869

the countries of Europe the general military service is becoming universal, in such a way, that a number of combatants unparalleled before, are to be foreseen in future wars. We should therefore be employed in perfecting our sanitary organizations. The technicians of war have been able to proportion the thickness of the armor-plate to the penetrating power of the projectiles; they have multiplied the means of defense in the same degree that the force of the engines of destruction has increased.

With us rests the task of developing the organization of our war surgery, so that it may remain on a level with the sad needs of our times. American surgery here again has furnished us with important illustration.

Keen's Surgical Encyclopædia contains admirable studies, for which we are indebted to our eminent colleagues Borden and O'Reilly, who have faced the problem with perfect capability and experienced reasoning, to whom all homage is due.

These authors have rightly laid stress on the weight of responsibility which the practice of military surgery entails, and on a previous and altogether thorough medical organization. The precautions that would have sufficed formerly, are inadequate at the present day.

I must be permitted to draw the attention of this chosen public to the existing state of affairs, that the international understanding should be reinforced more and more by the organization of help for the victims of war, is a thing greatly to be desired.

Without doubt this understanding already exists, the Red Cross is the most striking illustration of it, and at the time of the last Balkan War, we saw ambulances which had come from all countries, repair to the seat of war.

When I arrived at Constantinople in November, 1912, with the Belgian ambulance, I already found the American ambulance installed and in full working order, under the direction of your eminent countryman, Doctor Ford.

This international fraternization is without doubt an encouraging sight, this humane impulse cannot be praised sufficiently.

To augment the number of these foreign interventions is much to be desired, not, however, exempting Governments and Administrations from local organizations of help.

It is the insufficiency of the latter that must be remedied, because we must, alas! think of future wars, let us remember that our responsibility as surgeons increases with the dangers of the present time.

The Balkan War has only emphasized the lesson taught by the

Manchurian War the fate of the wounded depends more than all on the aid which is given in the front of the battle, for as long as the engagement lasts, the exposed ground is inaccessible for the ambulance men, of whom more than one has sacrificed his life in spite of all precautions taken, thus hours pass, during which the men remain without help

Schaefer³ has drawn a heart-rending picture of this deplorable state of things Haga⁴ acknowledges that it is no longer possible for the ambulance men to circulate on the battle-field, exposed to the hail of the shrapnels What is to be done?

The following is without doubt the solution each of the combatants must carry with him, side by side with his cartridges, the objects necessary for a first dressing This solution has already been accepted and taken into use in different countries, at the most an improvement on this idea could be realized, by adopting a model of uniform packet for first aid, but the experience of the late wars has only proved too clearly that, before all, the sanitary education of the soldier must be improved

He must fully realize the dangers of infection, by earth, dust and water, of what use is a disinfected compress, if it is soaked in polluted water?

A soldier must also possess knowledge of certain simple facts, for example, he should be aware, that in case of a wound in the abdomen, it is better to rest motionless, even if for hours, than to walk as far as a station

The military instruction of a soldier in future will not be complete unless it comprises an acquaintance with the necessary measures to take for his personal safety, and especially the elementary rules of asepsis and antisepsis The making general these instructions will result in a great saving of human life, I think

Do not let us even leave the bringing of first aid to the wounded for the ambulance men, as thus, it may often arrive too late

May I be allowed again to call your attention to a certain point?

If it is true that immediate help is the most efficacious on the battle-field, it must be considered that this help should be limited by precautionary measures, the stations at the front, those temporary erections which change place as the troops change, and cannot be provided with the necessary implements as hospitals, are only stop-

³ Schaefer *Archiv für klinische Chirurgie*, 1906, p 915

⁴ Haga *Kriegschirurgische Erfahrungen*, 1897

ping places, where the sick and wounded are sorted out. Unfortunately they are not always made use of in this way during the Balkan War the Turkish army doctors and others tried to extract the bullets and amputated in the ambulance at the front, and we were able to certify that on the arrival of the wounded at the hospitals of the town, the greater part of these interventions had produced deep-seated suppuration

In the hospitals of the second line, which never change place whatever happens, the operations could be performed that were judged indispensable

There experienced surgeons should be placed, who would have to decide the serious questions, and the most pressing and grave interventions would be decided on and carried out in these hospitals of the second line, where the wounded could be taken whose condition did not permit of a long transport

Civil consulting surgeons should also be attached on regular duty; from every point of view this addition seems to be desirable, the presence of these civil surgeons at the hospitals would give them a neutral character, which they have not at present. The capability of these consulting surgeons would assure the utmost caution being used at the critical moment, when the fate of the wounded is in the balance, in short, these tried surgeons would oppose the performance of all operations, of which they did not clearly see the urgency

We all know that a man surprised by a traumatism can oppose less resistance to a general shock, than another who has had the time to prepare and arm his organism

The wounded leave the battle-field discouraged, worn out, and join in general the number of "bad cases", therefore still more reason to be careful

Respect for human life should be our only guide. The finest operation is not always the most well directed, neither the battle-field nor the surgical clinic allow of experiments on human beings.

The discharge stations should keep up their character, therefore the addition of experienced civil surgeons appears advisable. During the last wars, a fact which filled all the surgeons with astonishment, is the comparative harmlessness of the modern gun, of it has been said that it is a "humane weapon" as if these two words would not swear at finding themselves together. But for a fact I have seen, and others have also seen, bullets which had pierced the arm or the leg sometimes throughout their whole length, and others the abdomen

or the breast or even the back of the brain without producing infection or any serious consequences

The fact was so generally remarked upon, that the military authorities took up the matter, it is not uninteresting to notice this, just at a time when the effects of the cannon have become more deadly than ever.

Surely we surgeons will not reproach the modern gun for not killing his man with every shot, what we do desire is to reduce the so-called "efficacy of the shrapnels," it is too horrible

At a meeting of the Imperial Surgical Society at Constantinople, December, 1912, just at the time when we could hear the thunder of the cannons of Tchatalja every day, we expressed the fervent wish, that the use of the shrapnels might be abolished on the same grounds as the explosive bullets

To military men this wish may appear naive, I do not deny it, but at the same time let me tell you, that I am not in any way ashamed of it

It seems to me that here, so far away from the lands divided by a deadly animosity, you will appreciate this wish as a protestation against the cruelty of war. Yes, I boldly state, that we who are brought into such close contact with the dreadful miseries of this poor human race, find it more and more difficult to understand, why men do not employ their reasoning powers to a good end by ceasing this destruction of one another. We hope soon to see the "United States of Europe" in friendly intercourse with the "United States of America," and if we salute the eminent men present at this Congress with profound respect, we reserve our deepest admiration for those amongst them, who, following in the footprints of Franklin, Lincoln, Roosevelt and Carnegie, work to assure universal peace

AMPUTATIONS*

BY PROF. OSKAR WITZEL, M.D

OF DUSSELDORF

THE removal of limbs has undergone a great change in the last decades. During this period amputation has become an art which can no longer be considered a beginner's task. In emergency cases every physician must be able to perform this operation at once, if necessary to save life. But otherwise it demands the highest surgical skill, both in determining the indication and in the proper execution.

Amputation has become rare in the surgery of peace. By all possible means its use is being reduced also in war. In the great traumatic epidemics even to-day more limbs must be sacrificed, it is true, to save more lives under the stress of circumstances which it is our constant aim to alleviate. For in time of war it is our highest duty to procure as far as possible the help available in time of peace for those who stake their health, their life, for the welfare of the nation.

The progress of surgery makes it possible under the protection of a simplified and certain antisepsis and asepsis, to wait longer in treating lesions, in order to see what is in reality traumatically destroyed, and what may unexpectedly recover. Crushed parts which infection formerly made a menace to life, can now be preserved. What Lister emphasized as the guiding principle in the treatment for wounds—to let alone—has been disregarded, almost forgotten in the overactivity of our antiseptic era, very much to the disadvantage of the wounded. Von Bergmann rendered a service of incomparable value in introducing simple measures for open fractures in war and insisting with all earnestness on their use also in time of peace. Extremities whose removal seemed hitherto inevitable in consequence of vascular lesions are very often successfully preserved in time of peace by means of operations on the vessels, suture, anastomosis and transplantation. The benefits of these advances have already been extended by practiced hands to the wounded in military hospitals. The gradually increasing occlusion of the vessels, such as threatens the extremities with gangrene in arterio-sclerosis, can be combated through anastomosis of the large arteries and veins. In this way the future derangement of vitality becomes a rare indication for the removal of a limb.

* Read before the International Society of Surgery, April 11, 1914. Translated from the German of the author by Dr. Oswald Joerg.

The sequelæ of acute inflammations and of chronic inflammatory changes put before us the question whether to amputate or not, irrespective of whether the fault lies with the patients or their physicians. Not only as a prophylactic in the very beginning, but also as a treatment at the height of the inflammation, the measures recommended by Bier, especially for the extremities, achieve remarkable results in removing the necessity for a mutilation. If there is any suspicion of the wounds becoming infected (they are all, briefly speaking, affected at least by an "infectio minima insensibilis") we may avert phlegmonous processes through hyperæmia induced by bandaging (Bier's hyperæmia). If they do appear, nevertheless, incisions which preserve the tissues are used together with the hyperæmia in order to prevent sequelæ and general health-endangering conditions which even to-day may ultimately require amputation. In the further development of surgical interference which has made unnecessary the removal of congenital and gradually forming *deformities*, we have learned, if contusions or inflammations were followed by strongly disturbing sequelæ, to perform operations on the bones, joints, musculotendinous apparatus and on the nerves which restore them to painless use.

The indication to amputate on account of the *formation of tumors* could be modified by resections in cases of benign tumors, also in the case of myelogenous sarcoma, plastic operations and transplantations, are aiming to replace completely the removed parts in regard to form and use. By means of radiotherapy, the powerful assistant which has come to the aid of operative surgery, we hope to be able to limit mutilation also in the case of tumors which until now, even in the early stages, offered a prospect of cure only by immediate amputation. In the case of the extremities this holds good especially for periosteal sarcoma.

The right to the judgment that a limb cannot be saved, therefore, presupposes an exceptional familiarity with the progress of our science. An equally exceptional ability is required for the execution of the amputation.

The necessity to draw upon such knowledge and ability may come to the non-operating general practitioner at any hour. He must, therefore, know the modern demands of amputation, especially with regard to the changes in the establishment of the indication. In full appreciation of the minutiae through which the very best can be obtained in clinics, we must endeavor to simplify our proceedings to the utmost with regard to the execution and the necessary remedies. The dictum of Boerhaave *simplex sigillum veri*, is peculiarly true in practical medicine and in "emergency amputation" in peace and in war, but it is also true

in the case of "interference which is optional as regards the time of execution"

The execution is never so urgent that the demand to raise the capacity of resistance against the effect of operation could not be fulfilled. Where the date of the operation is optional, neglect of careful preparation for the purpose of increasing the strength of the patient is a gross technical error. This preparation may take days, even weeks. Here, in advance of the surgeon's skill, the physician's foresight is to come into play, especially in regulating and strengthening the heart and cleaning the air passages by prescribing both medicines and systematic breathing exercises which later on also afford the best protection against thrombo-embolism. In the case of emergency operations, the measures for strengthening the general health coincide for a short time with the technical preparations for the surgical interference. When treating a trauma, before the patient goes to the operating table, the heart excitants, ether and camphor, are given, with the great quieter, morphine. Where it can be done, the quantity of blood is increased by salt infusion—provided there is absolute safety against further bleeding. This may be rendered more valuable by oxygen inhalation. Above all, the bloodless need protection against loss of heat. Provision must be made for warming the operating table.

Certainly, also, the interference in itself is an injury. Possible developments that may arise (during the operation itself) must be so carefully considered in advance that death on the table during operation may be excluded, and where the case is known to be a hopeless one, the operation should never be attempted.

A mortality, caused from the amputation itself must be absolutely excluded, even when section occurs high up near the trunk. The patient should never lose his life during operation through impairment of the circulation and the nervous functions. He must be guarded against further danger of life after the operation. To accomplish this there must be a positive arrest of hemorrhage and an absence or at least a minimum of pain in the care of the wound, and perfect technique of the operative procedure. But nowadays even more important than conserving life and bringing about a final cure is the accomplishment of a condition whereby the usefulness of the stump, as far as its strength and mobility are concerned, is attained.

Great progress in the direction of arresting hemorrhage was made by Esmarch and his achievements are all the more notable because of the simplicity of his method and the surety of its outcome. Even on the battlefield a surgeon or in case of necessity, an experienced assistant,

can exclude the blood from the particular member about to be amputated by applying elastic bandages and elevating the limb

The fastening of the ligating tube requires special means in cases of high amputations and for exarticulation at the hip- and shoulder-joints. The tube applied in figure-of-8 turns can be fastened by suture and secured against slipping off by means of large needles and stick-pins. Sometimes the external iliac artery or subclavian is to be ligated, even permanently, as long as it does not endanger the vitality of the flap well provided for by collateral vessels; otherwise temporarily with a loop which will be taken off as soon as the large vessels in the turned-over flaps are cared for. In Momburg's compression of the aorta by an elastic bandage around the abdomen, which had a forerunner in Esmarch's somewhat more complicated compression of the aorta, an excellent method of prophylactic hæmostasis at the root of the thigh and of the pelvis is also given to military surgery.

It must be always emphasized that in cases of amputation the prevention of pain is an essential factor. The exclusion of the psychic factor through a general narcosis which may be brought on as early as the night preceding the operation, is a command of humanity which is to be fulfilled whenever possible. To the one patient camphor and morphine are administered before the emergency operation, to the other veronal or laminal the evening previous in order to induce a thorough night's rest. An hour before beginning the narcosis there should be given a clysma with alcohol and tea and a dose of morphine as a result of which the patient will arrive half asleep in the operating room. Afterward, for the real narcosis, *ether*, not chloroform, is to be used,—for wounded patients suffering from severe hemorrhage or shock only a minimal quantity, applied in the right way, is required. There can be no doubt in the mind of anyone who is familiar with our combined ether-drop narcosis as to its reviving effect in cases of collapse.

Other methods of anæsthesia are employed only in very special instances, *e g*, *Bier's lumbar anæsthesia* for amputation of the leg because of senile gangrene. Here, too, general anæsthesia has been used as long as no complication with diabetes is present which contra-indicates the cerebral narcosis on account of the danger of coma. But the use of anæsthetics in the spinal cord, though possible for the removal of the leg, can as yet not be considered for the amputation of the arm. For it is accompanied, when applied to a very high point, with a great degree of danger so that it must not be attempted unless no other remedies exist. A method very suitable for major operations on the upper and lower extremities is that of Braun, it can be perfectly performed in the brachial

plexus for the arm, for the leg with injections into the sciatic, crural, obturator and the cutaneous branches of the femoral nerve. Harmless by itself, in connection with remedies diminishing the capacities of feeling and thinking, this method may find its place where the cerebral narcosis is impossible. Hackenbruch has shown that for the high amputation of the leg, even for Chopart's complicated operation, the injection all around the nerve may cause perfect painlessness. His method, however, cannot well be used in major operation. It is excellent for minor operations in the realm of general practice, especially because it does not largely take anatomy into account.

To encourage the *healing process of wounds* the older surgery preferred the most simple methods of removal, *i e.*, in which smooth surfaces are formed. With open treatment, often uninterrupted cure would follow. Even to-day preference is given to the circular section for amputation in cases when the parts are greatly infected. Even to-day open treatment should be used, provided it is important to avoid any retention of secretion. Besides, the amputating surgeon must have full mastery of an asepsis which forces the quick healing *per primam intentionem*. He must work with an antiseptics which shortens the process even where the operation is to be performed in infected parts.

The decision whether the removal—even with peripheral infection—falls into entirely clean parts or not, is of first importance for the further procedure and the success. Usually it is easy. But often it is, even with experienced surgeons, not to be accomplished without difficulty. If we remove congenital superfluous parts or limited malignant tumors, we must be sure of the cleanliness in the sphere of operation. On the other hand, we are also sure in many cases to have to force our way through infectious tissue, through lymph passages carrying germs, even through larger inflammatory foci. Consideration before decision, care for the success, must rule our action in these different types of cases. Experience must tell us whether we have to sacrifice more to attain uninterrupted aseptic care, or whether we have to proceed antiseptically to save more, as well in the preparatory treatment of the parts, as in abundant evacuation of secretion, as in the after-treatment. At the same time we have to come to the decision in regard to the height and the mode of the amputation.

Where age is to be a determining factor in deciding the type of the operation we must remember that in young tissues we can count upon good plasticity for the union, whereas old tissues demand simple junction, if the question of the blood supply is to be considered, disturbances in its quality, especially diabetes, are to be considered in planning the

technic, the chief condition for complicated operations is to have the entire region in an aseptic condition. An infection that could not be removed before demands simple procedures.

The problem of the safe protection of wounds is much greater in cases of amputation than is generally believed. The resulting wound becomes sinuous, as hardly any other one, in consequence of the irregular muscular and tendinous retractions, even when the plain circular and oblique section is used. We must always be watchful of "dead spaces." We shall hardly learn how, by any calculation as to the different retraction, to accomplish the separation so that a smooth wound will be the outcome. In the case of some amputations we know that certain positions of the joint, above and below, assist in securing a smooth wound. The rest must be done with buried sutures which unite the separated layers throughout the entire extent of the wound. Even then an uninterrupted healing cannot be expected, unless another postulate is fulfilled, namely, that the tissue layers enclosed in the healing process have not lost their vitality.

The separation of the soft parts must be done smoothly with a sharp knife. The use of scissors still crushing is to be avoided as much as possible. The soft parts are extended in the following manner. The upper half grasped by the hand as far back as possible is stretched toward the trunk, while the lower half is being pulled with the aid of an assistant. With sharp-pointed hooks we lift off the flaps, with a toothed forceps we draw down the nerves and vessels to be removed, and grasp muscles, tendons, and the edges of the skin for reunion. Every contusion is avoided, for it leaves the parts, if not directly crushed, deranged in their circulation and prone to infection. Even during the short interference of a simple operation, trifling drying and cooling are to be avoided, especially if the circulation is artificially shut off, since they tend to cause congestion and secretion from the surface of the wound. If we do not pay attention to this precaution we damage the most superficial tissue layer, as was the former rule, when applying antiseptic, corrosive remedies. With the object of preserving the tissues we omit the antiseptic, chemically necrolizing substances even where we must pass wholly or partially through infected tissues.

Only in tying a vessel and for buried sutures we are compelled to bring an antiseptic agent into the wound. Heretofore we have not possessed a thread material which fulfils its mechanical object and is aseptic, free from antiseptic agents. The effort so often tried to use only sterile threads has always resulted in failure, in so far as the threads introduced as foreign bodies cause irritation that in turn de-

velops germs which are present in each wound and are carried into the circulation. Threads antiseptically prepared of great durability are selected, and chloride of mercury silk prepared in accordance with Kocher's prescription is immersed in wounds which are able to heal *per primam*. It disappears, "substituted" by a very slowly advancing dissolution. In infected wounds we use catgut which is quickly absorbed, so as to avoid the formation of thread fistulas with the healing of the tamponed cavity.

Besides careful ligation of the large vascular trunks and of the visible branches, the other measures against hemorrhage, applied immediately after operation and also subsequently, are of great importance for the healing of the wound. Esmarch's artificial anæmia during the operation is for this positively an aggravation. An increased number of ligatures beyond what is necessary in another wound of the same size must be applied, if we first loosen the constriction at the wound still open, and then ligate the vessels. We cannot avoid this if we operate upon tissues the vitality of which is reduced by arteriosclerosis or contusion. Not to be obliged to bury too much thread material, we make sufficient use of torsion, the technic of which seems to be lost, at least for the text-books. It is done in the following manner: the spouting end is pulled out, then held across with a second pincette, when the former closes and pulls off the point by turning. Where we operate in really vital parts, we apply a row of sutures in the depth, then unite the skin and then loosen the constriction. To check the profuse hemorrhage arising from the blood shooting into the sewed-up stump, we make long-continued manual pressure.

In order to be assured of an uninterrupted recovery, the operation itself must be such as may be characterized by the three words, "gentle, moist, warm." Again the vessels must be well closed, which prevents the subsequent extravasation of blood and lymph and with this the collection of nourishing media for germs in void spaces.

The securing of primary union is hardly of such importance for the future function in any other wound as it is in the case of an amputation, and consequently we must be conversant with seeming trifles which, in this regard, have importance. Drainage, even when short tubes are used, is to be avoided, whenever possible, for it renders the desired fine cicatricial line broader or causes a button-hole scar. At any rate the drain ought to be removed in the first days. But each change of dressing considerably disturbs the rest which is very necessary for the amputated stump.

A very essential completion of asepsis in the amputation wound is

offered by the mode of dressing devised by me which I have called a wound-pull-dressing" The pull-dressing of adhesive plaster was first employed by me for amputations done on account of senile gangrene But it offers extraordinary advantages for all types of amputation With a broad adhesive strip applied over the wound dressing and reaching far up, it relaxes the sutures, if the wound is entirely closed, compresses slightly the cap formed out of soft parts, and pulls it off from the bone and prevents, if the wound is left open, the strong retraction of the flaps of the cuffs This dressing brings, in a very agreeable way, rest to the stump and safety from agonizing spasms, without a weight upon and bindings around it

The careful protection of the wound prevents either circumscribed or far-reaching infection Through many well-considered and executed particular measures, we owe the steady decrease of the former "classical" mortality

Even on the battlefield where the time of the attending surgeon is limited, the fulfilment of the operative task has to be done within the bounds of the foregoing remarks The risk to life through operation must be excluded *per se* One thing, however, is to be demanded, that the mutilated must be saved from the terrible torture of amputation neuralgia Also for this it needs but simple measures

More than 25 years ago, Billroth requested his colleagues to communicate their experiences relative to the cure of this horrible malady which, even in the modern text-books, is frequently considered to be a result of the formation of "amputation neuromas" On the basis of examination of old amputation stumps, both in preparations as well as in living bodies, I was able then to show that the amputation neuroma, the terminal intumescence of the bisected nerve, is the result of an abortive effort of nature to regenerate the lost part towards the periphery This attempt (of nature), which happens rather frequently, leads to the rolling up of the neoplasm in the form of roundish masses Provided these knobs were always a sign of the amputation neuralgia, we ought to cease operating It was shown that with stumps of patients suffering from neuralgia the cause is not the terminal intumescence, but the fixation of the nerve to the secondarily formed scar and of the latter one to the bone At first very sensitive to pressure, as may be easily understood, the stump gradually becomes the seat of the neuralgia through irritation of the "glued together" nerve-trunks through flexion and extension It is well known, that the neuralgia ascends the nerve-trunks—as anatomical foundation a perineuritis nodosa is found which also fixes the trunk further up and prevents it from making sufficient

excursion in its sheath, which is a physiological necessity. This condition is not unlike the difficulty of redress which finally becomes an impossibility, as even sections and resections at the origin of the nerves in the spinal cord remain of no avail. Simple and sure was the prophylaxis which we recommended even at that time! It does not require the neurincompsis later developed by Bardenheuer, nor the cuneiform excision with subsequent very fine suture of the perineurium according to Ritter. These are methods which are at least difficult with thinner trunks and cannot at all be performed on the battlefield. We taught to save the nerve end from being fixed, for this is the cause of the neuralgias, by strongly drawing forth—that can easily be done with most of the trunks up to 4 or even 8 cm—and by smooth separation by means of a sharp cut with the knife. We encourage our pupils to execute this manoeuvre upon the nerves always prior to division of the vessels. The end slips far back into the layer of connective tissue and later on glides painlessly with the “neurom” to and fro. This excision must be made the more carefully and higher up according to the possibility of a secondary healing of the wound.

But the demands of modern times for the success of amputations are not limited to the exclusion of danger to life, the achievement of uninterrupted healing of the wound and avoidance of the coarse disturbance of the amputation neuralgia. We have to *produce stumps of the highest usefulness*. We already possess sure and, fortunately, very simple methods to facilitate accomplishments which we formerly believed to be absolutely unattainable.

Provided we do not desire to have the stump hang useless, swinging in its capsule, and if we want it to serve actively to the motion even when directly loaded, it must be, in the first place, painless, free from pain when the soft parts are shifted or pulled at, or pressed against the end of the bone. But the stumps of the diaphyseal amputations made in accordance with former methods were rarely of this kind, and this was even more the case with the deformed stumps arising from exarticulations or amputations in the epiphysis. To bring about painlessness in the latter group, uninterrupted healing *per primam intentionem* was the necessary supposition. Stumps of the articular extremities healed by suppuration and with broad adherent scar.

The excellent investigations of Bier have shown under what circumstances a stump may be entirely painless and remain so. The conception of Bier in regard to the cause and nature of the sensibility is indeed still under dispute.

On the stump formed after the method of Pirogoff the patient, after

ment even for the application of the prothesis. The contractures developed this way have been combated by tenotomies, thus, in a crude way, by disconnection of power in the lever of the stump. This is evidently wrong. On the contrary we are now striving from the beginning to avoid the antagonistic disturbance, the deficiency of a whole kind of movement, leaving sinews and muscles longer in the stump and fixing them by suture to the neighboring ones near the bone. Of especial value through its simplicity is the procedure which unites the muscles and tendons of one side, sewed up with each other and combined into a well working mechanical totality, across the stump with its antagonists treated similarly.

In obtaining such an equilibration much remains to be done with respect to the physiology of the stump. What cannot be satisfactorily achieved in the first way, must be obtained secondarily by orthopædic operations.

Finally, we must consider the utilization of single parts of the musculotendinous apparatus for the intended transmission of movements upon the prothesis. For the leg it suffices that the stump may be supported directly and painlessly, and that it acts as a lever in good order, but for the hand we must ask and achieve more.

Vanghetti proposed to use tendons to form rings through which strings may be framed which shall transfer movements to the prothesis. This procedure is doubtless valuable. We would even now adopt it in cases of reamputation on forearm stumps, whenever such opportunity appears. Unfortunately, a longer time is apt to elapse before opportunity for such an amputation of the forearm is given. It follows that in cases of amputation at the wrist-joint the tendons of the extensor digitorum communis, of the extensor pollicis major and minor, may be united to form a single loop, the same may be done on the flexor surface. There results on the dorsal and volar side one ring for the thumb, and one for the four fingers in the skin sac. It need not be specified here, just how, after *prima intentio* has resulted, such loops based upon the principle of the ear-hole are to be made in a plastic way.

Merely worthy of mention is the attempt to produce actively movable levers out of periosteal fragments of bone, retained at tendinous insertions, as, for example, the two-step transplantation of a finger, for instance, a stiffened ring-finger of one hand as compensation for the thumb of the other, as well as the two-step transplantation of a piece of rib, originally enveloped *in loco* with skin, to the place of a thumb, an effort in which we have been successful.

accordance with Wilms, using the tendo Achilles or the tendon of the triceps humeri, on other occasions the diaphyseal stump is to be treated under ordinary circumstances, certainly always by the physician in the field, after Bunge's direction. With amputations in the epiphyses it needs no cover-formation, scraping with a spoon or periosteum-removal, but here, like at the exarticulations, an improvement through removal of corners and edges may be made.

The last fear of the nerve-fixation may be removed, provided—as Hirsch suggests—we execute in all different proceedings early and methodically the shifting of the parts against each other, beginning by *massage à friction* towards the periphery, afterwards by tread-exercises or by direct loading of the stump in a provisional self-made wooden leg (Bier). It is astonishing to see, how well such manipulations for securing the mobility of the cover of the soft parts can be tolerated even after two weeks, *prima intentio* just accomplished, and how after four weeks the stump can be used as a firm support, and how a patient with both legs amputated walks around upon the stumps only protected by wrapping.

It may be mentioned that Hirsch's treatment of exercise and massage is capable of rendering stumps painless, even though they have been obtained by other methods and are already becoming sensitive, and that it works excellently after the reamputation which became necessary on account of great tenderness.

It is gratifying to note that from a complicated method we have been able to finally devise a simple one, applicable everywhere, and which affords a painless stump.

But this is not enough. A lever thus obtained tolerates, according to our wishes, direct pressure and pull in the artificial limb. It ought to move the latter as well as possible as a lever working as a whole, the most important isolated movements of the artificial limb—this is the last request—might be executed actively, dependent from the will-power in using the musculotendinous apparatus terminating in the stump. The prothesis shall be “revived” by the stump. To secure the first object it is necessary to equilibrate the lever-effect, and that is mostly done after simple calculation in uniting by suture or insertion the muscles and tendons.

Added attention given to the function of the stump has shown that disturbances were brought about through irregularity of muscle-effects, stronger on one side, producing a preponderance in the sense of motion, extension and rotation. In short stumps of the legs and thighs, but also of the fore and upper arms, the resultant positions may be an impedi-

ment even for the application of the prothesis. The contractures developed this way have been combated by tenotomies, thus, in a crude way, by disconnection of power in the lever of the stump. This is evidently wrong. On the contrary we are now striving from the beginning to avoid the antagonistic disturbance, the deficiency of a whole kind of movement, leaving sinews and muscles longer in the stump and fixing them by suture to the neighboring ones near the bone. Of especial value through its simplicity is the procedure which unites the muscles and tendons of one side, sewed up with each other and combined into a well working mechanical totality, across the stump with its antagonists treated similarly.

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AMPUTATION OF THE HAND†

BY DR. P. VON KUZMIK

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THE surgical treatment of amputations and exarticulations in recent years has been as conservative as possible. The practically perfect application of *asepsis* and *antiseptis*, the extraordinary results achieved by the newest curative methods, the improvement in and the more thorough utilization of the methods of investigation in every respect have naturally strengthened the conservative point of view which is so important for the patient. This attitude is especially important with regard to the preservation of the upper extremities, the hand and the fingers, the loss of which, despite great technical progress, cannot yet be replaced satisfactorily.

While an able surgeon can to-day so remove the lower extremity that the patient shortly after the operation may, by means of an artificial limb, regain his entire ability to work and be able to conceal his defect completely from the layman, the loss of a hand, the fingers and even of individual joints of a finger, materially reduces the ability to work, and the deformity due to the mutilation can hardly or not at all be concealed. The fault for this regrettable condition does not lie in the surgical technic, but in the method of replacing the defects caused by amputation, as the mechanics of to-day can hardly boast better and more perfect results than at the beginning of the sixteenth century with its replacement of the right arm of *Goetz von Berlichingen*. Our aim should, therefore, be to save the hand and its smallest parts by exercising great patience and care and by the use of all the scientific means at our disposal.

Limited mobility, ability to use the fingers, and a stiff wrist represent such progress as compared with amputation, that a conservative procedure should always be tried before resorting to more drastic measures. Therefore, before discussing the question under consideration, we consider it proper to mention briefly the methods by which the aim previously mentioned can be attained and mutilations avoided.

Our endeavors are unsuccessful, of course, in many cases still.

* Read before the International Society of Surgery, April 13, 1914. Translated from the German by Oswald Joerg, M.D.

especially in *lesions* in which severe contusions exclude conservative treatment. More frequent use is constantly being made of the newest acquisitions of science which make possible not only the replacement of tissues and organs, but also of the extremities, as shown by *Carrel's* experiments.

In traumas, mutilations are often unavoidable, but in the case of inflammations, mutilation can in many instances be avoided by proper knowledge and experience, and with the aid of all the recognized procedures at our disposal hands and fingers which, ten or twenty years ago, would under all circumstances have been sacrificed, can nowadays be saved and even restored to usefulness. In *acute processes* many hands and fingers have been restored to their full working capacity by means of a prompt and energetic but cautious operation, care being taken not to injure the bone, the tendon sheath, or the joint, by means of rest, or by the use of *Bier's* treatment, or possibly even by the application of serotherapy, or *Bacelli's* bichloride of mercury treatment.

However justifiable in *acute inflammatory processes* prompt, energetic, but cautious measures may be, an attitude of patient observation is both advisable and justified in the care of *chronic* and especially tuberculous processes. Especially good results have been obtained, particularly in surgical tuberculosis, by means of *Rotter's* heliotherapy, now that this method can be successfully applied in the care of the hand, it is our duty first to try it in each case.

From our own experience, also, we can mention cases in which absolute rest and insolation have cured hands considered incurable because of the processes affecting the carpal and metacarpal bones, to be sure, the wrists remained stiff, but the fingers were able to work. Two cases under my observation came under my treatment in a totally neglected condition, with several fistulæ, indicating mixed infection, and the patients themselves wanted the amputation. On my advice, however, a conservative treatment was applied and after months both left the hospital cured and happy.

With regard to cases in which only some of the metacarpal bones or phalanges are diseased (*spina ventosa*), or if a conservative treatment does not lead quickly enough to the desired result, or if it is feared that the affection will spread to the soft parts, the attempt may be made to replace the diseased bone by a piece of bone covered with periosteum (tibia, ulna, radius). In this way we save the finger otherwise deprived of its support. This method must be applied in such cases for the reason that parts of bones can be transplanted only in healthy soft parts. Insolation can also be supplemented by specific vaccinations.

AMPUTATION OF THE HAND

In the *technic of amputation of the hand, fingers and individual parts of the fingers*, our principle is, except for a few changes, still the same as for the larger extremities, namely, to endeavor to insure the greatest possible serviceability of the stump, *i e*, to reduce to a minimum the disability which it causes the patient. In preparing the flaps covering the wounded surfaces we should see to it that the *cicatricial line* falls on the least exposed part of the stump. Therefore, we should take pains in amputations of the hand and fingers never to bring the cicatrix on the *volar side* of the palm. This is especially important in the amputation of the metacarpal bones.

While scars on the palm impair the grasping ability of the hand in the case of the fingers, it is the sense of touch which is influenced by scars on the side of the flexors.

In order to insure the greatest possible recovery of mobility in the fingers and wrist Riobanc, Koch and Wilms recommend (Kocher even insists upon it) that, in amputations of the fingers and phalanges, the *stumps of the tendons be united over the stumps of the bones*. On the other hand, Beely considers it entirely sufficient for the purpose to fasten the tendon stumps only into the connective tissue or the fascia. Beely's procedure cannot replace that of Riobanc, Koch, Wilms and Kocher, inasmuch as in the latter case the joining of the tendon stumps not only makes for their attachment, but the skin also gains a foundation, while with Beely's method the flaps of the skin tighten close to the bone as a result of the retraction of the tendon, a fact which can also impair the undisturbed healing process of the wound.

Although few adherents will be found, Vanghetti's method should also be mentioned, which he recommended in the case of a congenital lack of the forearm. Vanghetti makes nooses out of the tendon stumps and covers them with skin. These nooses, he claims, would be fit to hang things from, a measure that would increase the utility of the stumps.

The different disagreeable complications of the older methods of amputations—exostosis in consequence of hypertrophy of the callus, the formation of neuromata arising from the fixation of the nerve stumps in the cicatrix, which often renders impossible the application of artificial limbs, the neuralgic pains which occasionally appear and embitter the life of the patient,—all of these can be, as it were, entirely avoided by the newer methods. Experience and especially the employment of Röntgen rays have shown that Langenbeck's subperiosteal method does not prevent the formation of exostosis and large masses of callus even in those cases in which the whole surface of the bone

wound had been covered with periosteum. Experiments have therefore been made to do away with these serious complications. Bier's idea—the osteoplastic covering of the bone—solved this question, and this method is applicable in every amputation, because it suffices if the osseous lamella, taken out of the part of the bone which has to be amputated, is connected only by means of a periosteal pedicle with the remaining part of the bone. The preparation of the osseous lamella, however, involves some technical difficulties, for often the osseous lamella necroses and must be removed, or in some amputations, such as the finger metacarpal bones, this procedure is hardly feasible, and for this reason we welcome whatever newer methods attain this end with ease and under all circumstances. To these belongs Hirsch's proposal to detach the osteoplastic periosteum from the osseous stump, in addition to which Bunge scoops out 3 to 4 c c of bone marrow in order to prevent ossification through the latter. This procedure has, in practice, proved itself feasible, for through Hirsch's and Bunge's methods even the stumps of the legs can be made capable of bearing weight. Recently, Ritter recommends covering the bone with fascia so as to avoid the formation of the disagreeable callus. This procedure answers its purpose also. Both of these methods are very well applicable in amputations of the hand and fingers.

To prevent the *formation of neuromata* as well as the growth of the new stump into the cicatrix is the aim of numerous proposals. Cushing recommends the union of the nerves, Ritter the removal of the centre of the nerve stump and the joining of its edges. Bardenheuer turns the end of the nerve and sews it into the nerve trunk. Witzel recommends the amputation of the nerve stump high up. Except for the last method the general tendency is to cover the wounded nerve termination approximately, by this means the formation of a neuroma is avoided. This tendency is very praiseworthy but not always possible. The technical difficulties are especially great in the case of the hand and the fingers, where the procedure of Witzel is the most appropriate, for if a neuroma is found, it is situated a great deal higher up, far from the stump, so that, lying in the soft parts, it does not cause any inconvenience.

In conclusion, the question may also be brought up, whether in a given case *enucleation* or *amputation* is preferable, especially in those cases where the removal of larger parts by amputation or exarticulation does not materially affect the use of the hand. This question must be decided according to the social position of the patient, for if in a given case, for instance, the thumb is sound and the fingers are

to be removed, we will enucleate the stumps of the fingers, if the patient is a workman, whereas with a patient of the better class we must try, if possible, to save parts of the first phalanges so as to avoid the displacement of the artificial fingers when covered with a glove

If, on the contrary, single fingers are to be removed we do not content ourselves with a simple enucleation to prevent the callus, the capitulum of the metacarpal bone must also be removed, partly for cosmetic reasons, partly because the interstice resulting from the simple enucleation disturbs the ability to grasp objects. In removing, *i e*, enucleating, the hand the processus styloidei of the forearm bones may either be taken off or left intact, as the uneven articular surface, if covered with a sufficiently padded flap, will not render it difficult to carry the prothesis, and the formation of a disagreeable callus, with its possibility of causing pressure, can thus be avoided. But if the principal flap is thin, it is advisable to saw off the processus styloidei and to cover the stump with the fascia. In sawing off the processus, respectively the articular surfaces, we must take care not to open the radio-ulnar articulation, as a lesion of it might unfavorably influence the pronation and supination of the forearm.

From the aforesaid it will be seen that all the great surgical advances as well as the general rules and successes of amputations are equally applicable to the hands and fingers and thus the limit of cases where amputation is indicated has been considerably reduced. Nowadays we are able to save hands and fingers, to restore or at least greatly to improve the usefulness of these members also in cases in which two decades ago a cure could be achieved only by amputation.

AMPUTATIONS OF THE LEG*

BY JOHN FAIRBAIRN BINNIE, C M

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THE level at which an amputation of the leg is performed below the knee has no influence on the vital dangers of the operation,¹ hence the choice as to the method and site of such an amputation depends first on the lesion for which the operation is required and second on the use which is to be made of the resulting stump

I The old general rule that amputation for malignant disease of a bone must remove the *whole* of that bone makes it evident that for such disease situated in the bones of the foot, amputation at any convenient part of the leg and by the best possible method is proper, while for the same disease of the tibia or fibula no amputation below the knee can be considered

If gangrene is the occasion for the amputation, the site of operation will depend largely on the extent of the vascular disturbance and this is best determined by the use of Moskowicz's method of examination Elevate the limb for two or three minutes Apply an elastic constrictor (not too tightly) as if for amputation and lower the limb to the table or into a dependent position After five minutes remove the constrictor rapidly In health the arterial circulation is reestablished at once and a hyperæmic flush passes down the limb to the toes in about two seconds If gangrene is present the flush rapidly passes a certain distance down

* Read before the International Society of Surgery, April, 1914

¹ Estes' statistics (ANNALS SURG, July, 1913) seem to show that amputations through the middle of the leg are less dangerous than those through the lower third and that both of these are safer than amputations through the upper third of the leg At the same time they show that an amputation through the knee is less dangerous than one through the upper leg A glance at his table shows that, while his figures are of course correct, the above conclusions regarding dangers may be entirely fallacious because, while he happens not to have had a fatality in 58 amputations through the middle of the leg, he has had one and only one in each of the other classes

		Cases	Deaths
Amputation through the	{ lower third leg	105	1 = 0.95 per cent
	{ middle third leg	58	0
	{ upper third leg	29	1 = 3.78 per cent
	{ knee	32	1 = 3.03 per cent

the limb, then pauses so that there is a clear line of demarcation between the hyperæmic skin above and the ischæmic skin below, then the flush slowly passes downward, taking minutes instead of seconds to reach the toes. *The line where the descending flush pauses* corresponds to the site of arterial obliteration and the limit to which the gangrenous process may be expected to reach. The amputation must, of course, be performed well above Moskowicz's line and the choice as to site of operation may be therefore exceedingly limited.

Sandrock's method is much simpler than the preceding². Scrub the leg vigorously in preparing for operation. Note the reaction of the skin to the scrubbing. The well nourished skin becomes diffusely red and this flush stops more or less abruptly at the poorly nourished level.

When the change is less abrupt, the transition zone shows either spotted or streaky redness. It may be necessary to wait a minute before reactive hyperæmia appears and it must be watched closely as it sometimes disappears rapidly. It is advisable to repeat the experiment on the healthy limb as a control.

When amputating for trauma the site of section depends on the site of injury and the amount of tissue which is left and which is suitable for forming the stump.

II The use which is to be made of the stump is a factor of prime importance in the choice of the site of amputation.

A If the financial condition of the patient is such that he cannot afford to indulge in a more or less expensive artificial limb, then it is of vast moment to save as much of the limb as possible and to provide him with a good stump, *i e*, one which will withstand abuse and on which the weight of the body can be directly, both continuously and intermittently, supported without harm resulting. This is the reason why so many excellent operations have been devised by which the heel is wholly or partly saved in amputation of the foot even although the result does not lend itself to the wearing of a comely artificial foot. The types of these amputations are Syme's and Pirogoff's, the latter being osteoplastic and having very many variants. In the same class of patient when amputation of the leg is required, it has been wise to do it at the so-called "seat of election."

The "seat of election" for bone section is one hand-breadth below the top of the tibia or about one inch below the tubercle of the tibia. At this level the flaps are almost always well nourished and the stump of

² *Zentralblatt für Chm*, 1913, No 27

the leg is long enough so that the patient can support his weight on the bent knee without the end of the stump projecting too far behind. A wooden peg with a padded shelf at its upper end on which the patient kneels with his stump, makes a useful and inexpensive artificial limb. The "seat of election" is quickly becoming a misnomer because improvements in the methods of operating are giving stumps on which direct pressure can be safely and painlessly exerted.

B The patient can afford a good artificial limb

Most artificial limbs are fitted to the stump by means of a bucket accurately moulded to the expanded upper end of the tibia, the lower portion of the stump merely occupies the hollow interior of the apparatus. Makers of artificial limbs consulted by the writer have stated that the lowest favorable site for section of the leg bones is eight inches above the ground and the highest point is about four inches below the lower edge of the patella. The improvements being made in the weight bearing efficiency of stumps must lead to the simplification and improvement of artificial legs. Now the main efforts after improvement in the technic of amputations are directed toward saving as much of the limb as is possible and providing an efficient weight bearing stump. If we can consistently secure an efficient weight bearing stump at any level, then it follows that for one who cannot afford a good artificial limb it is important to have no shortening of the leg, hence a Syme's or a Pirogoff's amputation is the best when feasible. If, however, a good artificial foot is procurable, it is better to amputate at a higher level so that there may be room between the stump and the ground for such an apparatus. From the ankle to the so-called seat of election it does not seem to matter much at what level amputation is performed, except that if the stump be of the proper weight bearing variety the more leg there is below the knee the greater power ought there to be in it.

If disease and circumstance demand that amputation be performed at a level higher than the "seat of election," then it has usually been advised to disarticulate at the knee as the articular end of the femur is accustomed to weight bearing and the portion of leg left below the knee is not long enough to be attached to and operate an artificial leg in such a manner as to use the normal knee motion.

Franke³ has pointed out that the flaps of soft parts required to cover the expanded femoral end must be very large and thus difficult of nutrition, hence he has devised an osteoplastic operation similar to

³ *Zentralblatt für Chir*, 18, January, 1913

Bier's in which the tibia is divided immediately below the joint but the joint is left intact—by this procedure the flaps do not require to be so long, there is less danger of necrosis and the weight bearing ability of the stump is excellent

When part of the foot requires to be amputated, the position of the line of bone section or disarticulation is of much importance. If it is safe and feasible to leave enough of the foot so that a shoe can be worn comfortably and use can be made of the ankle-joint, then there is no doubt as to the propriety of such an amputation.

Estes is a strong advocate of mediotarsal amputation and states that such a stump can be fitted with a thoroughly comfortable and practical artificial foot.

An artificial foot can be fitted to any good form of ankle amputation, but is said not to be so satisfactory or efficient as one fitted to a supramalleolar amputation.

The causes militating against efficient weight bearing capacity of a stump are.

- 1 Adhesions of the skin, etc., to the bone
- 2 Inefficient covering of the bone (scanty flaps, conical stump)
- 3 Irregularity of the end of the bone either from faulty division of the bone or from irregular callus formation
- 4 Stump neuromata and inclusion of nerve endings in scar tissue

Many, if not most, of these faults may be due to the condition of the patient (*e g*, trauma) demanding immediate operation and denying opportunity to carry out any complicated procedures.

Furthermore, endeavors to preserve as much of the limb as possible may force the surgeon to operate through tissues not entirely above suspicion as regards infection and vitality, as impaired by trauma or disease.

There are several means besides cleanliness of avoiding the above-mentioned faults.

(a) In dividing the soft parts first cut through the skin and fat down to the deep fascia, let the skin retract and then, cutting through the deep fascia, reflect it along with the skin, second, cut through the muscles obliquely upward and toward the bone, so as to make muscular flaps which will cover the bone evenly and themselves be smoothly covered by the fascia and the skin (J N Jackson)

Kocher long ago emphasized the necessity of accurate suture of the deep fascia. In amputations by transfixion the fascia is utilized as a matter of course.

(b) Hirsch and Bunge very strongly recommended that after the

bones are divided, they should be stripped of their periosteum for a short distance and Bunge recommends that the marrow be scraped out for a distance of about one-third of an inch. This practice, diametrically opposed to the older teachings, seems to lead to the formation of painless stumps, the periosteum and, according to Bunge, the endosteum being the source of tenderness in the stump. Kocher and J. M. T. Finney vigorously support the views of Hirsch and Bunge.

(c) When the wounds have healed everyone believes that it is wise to subject the stump to a reasonable amount of therapeutic abuse. Hirsch⁴ systematizes the abusive treatment very satisfactorily. He keeps the limb horizontal or in an elevated posture and either repeatedly hits the end of the stump or has the patient bump the stump against a board. After indulging in this kicking exercise sufficiently, the patient rapidly and frequently flexes and extends his knee so as to stimulate circulation. After a few days of exercise in bed the patient may repeat the exercises in the upright position and use the stump to support himself, after each seance of exercise he must lie down and elevate the limb. Before long even a rather poor stump may gain good weight bearing power by the above means. When time and conditions permit, one of the *osteoplastic* methods of amputating is to be chosen, for by such means a good weight bearing stump is almost sure to be quickly obtained. The importance of improving stumps is shown by the statistics published by Braunig⁵. He found that out of 122 amputations of the thigh and leg only a small number were able to bear their weight on the stump. In the majority of cases where Gritti's or Pirogoff's operation had been done the patients could walk on the stump even if there had been infection.

Cramer, quoted by Kocher, found in 92 diaphysial amputations of the thigh and leg, 70 with bad stumps and only 2 with weight bearing efficiency.

It would be useless to describe or even mention the numerous variants of Pirogoff's classical operation at the ankle or to describe Bier's equally classical method of amputating the leg, they are familiar to every surgeon. To the author it seems that Bier's osteoplastic operation and its variants are needlessly complicated and difficult. It is difficult to elevate the flap of bone by which the sawn end of the tibia is covered, it is difficult to make the proper periosteal hinge by which the flap is permitted to be turned over the tibia like a lid, and during

⁴ *Archiv für klin. Chir.*, 121, 743

⁵ *Deutsche med. Woch.* 1912, p. 2071

the necessary manipulations it is difficult to keep the flap of bone from falling off its periosteal covering

The flap or fragment of bone can get no nourishment from its periosteal covering and hence the periosteal hinge is of no use except *as a hinge* and this function is of no value in comparison with the difficulty of making and keeping it

The writer has come to the conclusion that all the advantages of the Bier's operation can be easily and safely obtained by covering the cut end of the tibia with a *free* transplant of bone

He has operated as follows By any of the customary methods (preferably a flap method) reflect the soft parts and so expose the tibia covered by its periosteum for a few inches below the proposed line of bone section Transversely divide the periosteum of the tibia along two lines separated from each other by a space about one-half inch greater than the diameter of the bone From the upper incision separate the periosteum downward for about two-fourths inch From the lower incision separate the periosteum upward for about two-fourths inch Cut through the cortical bone of the tibia transversely at the base of the periosteal flap With an osteotome or Gigli's saw cut free the plate of bone between the transverse incisions This plate of bone is covered by periosteum which hangs from its upper and lower edges like a tablecloth Preserve this in warm salt solution Complete the amputation by sawing through the bones after forming a periosteal cuff on the tibia Place the plate of bone over the cut surface of the tibia and fix it there by periosteal sutures The tibia and the plate might be united by chromicized catgut sutures introduced through drill holes instead of by periosteal sutures

If desired the bone plate may be made long enough to cover the cut surfaces of both tibia and fibula, extending between them like a bridge

As has been already stated, such an operation as the above is entirely out of place unless asepsis can be assured and the resisting power of the patient is satisfactory

FREE TRANSPLANTATION *

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FREE transplantation viewed clinically is of different significance than when looked at from the stand-point of the pathological anatomist, so that the question, What is meant by a success in free transplantation? may be and is answered in a different manner by the clinician and the pathologist. Thus the histologist may describe as a result of his microscopic examination, failure in the healing processes, in a case in which the surgeon has obtained a successful result, clinically. If a clinical success were dependent on the pathologist's conception of successful transplantation, the surgeon would achieve success only rarely.

The structure of the transplanted tissue varies in the successes as it does in the failures.

What eventually becomes clinical success can be grouped as follows

1. The approach to the ideal, where healing of the tissues takes place. Histologically, not only are the masses of cells held together, but vigorous regeneration occurs at the site of the wound flap, where necrosis usually is noted.

2. Healing occurs with a gradual disintegration of the transplanted tissue, but with coincident regeneration of the homologous tissues of the recipient, from those in the immediate vicinity. This condition is a most important one. The best example of it is seen in fresh transplanted bone which gradually disintegrates, slow regeneration taking place from the periosteum of the bone in which it has been implanted.

3. Healing takes place with complete encapsulation. The transplant here breaks down completely, but retains its shape. It becomes isolated like a foreign body, surrounded by a capsule so firm that neither absorption nor substitution can take place. In spite of this condition the clinical result may be a successful one, as, for instance, where fragments of bone are used to obliterate cavities, or when tendons or fasciæ are employed as bands.

In the clinical failures one meets with the following variations in the structure of the transplant.

* Read before the International Society of Surgery, April 15, 1914. Translated from the German by Dr. Max Lederer.

1. The transplant may be exfoliated after a few days, with suppuration. The cause is not a wound infection, but a malignant, non-bacterial suppuration, so severe that a gangrenous reaction may be the outcome. This is not seen very often, except when man-to-man transplantation is performed and the donor is suffering with tuberculosis or syphilis. For this reason such individuals are not desirable subjects for transplantation.

I believe in this class of patients who present themselves mostly for homo- or heteroplasty, that the difference in the serum and the cell proteins is markedly increased.

2. There may follow after healing a slow suppuration due to the foreign body, which ceases only when the tissue mass has become completely isolated.

3. A failure may occur after initial healing, because absorption takes place at a more rapid rate than does regeneration from the surrounding tissues. A not infrequent example is seen in transplanting the articular surface of the long bone of the arm, which has been denuded of its periosteum, where the bone is absorbed faster than new bone is generated.

4. After apparent healing occurs there is a disappearance of the tissue with cicatrization. In this instance the clinical result may be successful, as when tendons are transplanted, scar formation takes place, and they regain their normal function.

Aside from the bacterial and suppurative obstacles, one meets with other undesirable processes, as when the tissue mass becomes necrotic because of exuberant granulations which interfere with the blood supply, resulting in suppuration, absorption, and cicatrization.

The clinical result also depends on the type of tissue mass to be transplanted, as the more complicated in structure the tissue the more can we expect ideal histological healing. All types of tissue, as connective tissue, fasciæ, tendons, fat, tubular vessels, peritoneum, cartilage, and bone can be made viable in the homologous tissue of the recipient, and its regenerative powers increased with a consequent successful result, provided that substitution keeps pace with absorption.

It is common knowledge that the best results are obtained by means of autoplasty, in which method the transplanted tissue is grafted into the body from which it has been obtained. One must not believe, however, that a success in the histological sense is always obtained even in autoplasty, as here also come into play the variations in the site of the graft, the condition of the wound, as well as the damage done to the transplant. Only in autoplasty of the complicated tissues, as in trans-

plantation of organs, is a successful result always possible, in the clinical sense

In homoplasty, *i e*, the transplantation of tissues from one animal to another of a like species, success has been achieved only when the transplanted tissue was homologous to the mother tissues in the following types of tissues, connective tissue, fat, bone, etc, never with nerves, muscle, and organs, in which instances rapid degeneration and cicatrization occur. Fibrous encapsulation is met with more frequently in homoplasty than in autoplasty. This is probably due to the irritation of a foreign proteid, a difference, varying mostly with race, then with distant relatives, near relatives, and least with the individuals of one family. This variation prevents proper nourishment of many tissues, and, as a result, substitution in the regenerative process occurs very slowly while degeneration takes place very rapidly.

In heteroplasty, *i e*, transplanting from lower animals to man, or from an animal of one species to an animal of another species, scant success has been obtained. Kuttner has been somewhat successful in transplanting tissues from the ape to man. The tissue mass necroses as it does in homoplasty, except that, according to Schone, the transplanted material can be grafted after a few days into the donor with healing.

A survey of the above circumstances governing the behavior of the transplant makes it evident that the solution of the problem to obtain a successful result lies in the study of the properties of the tissue to be transplanted.

- 1 It must have the ability, when it is transplanted, to grow upon the foreign soil. The first factor is the viability of the tissue, as it is dependent upon its own lymph and circulation for nutrition. This viability varies with the individual tissue, as the higher the development of the cell—as the ganglion cells, nerve cells, muscle cells or parenchymatous cells—and the richer the tissue is in blood-vessels, the less likely it is to survive. On the other hand, the life of some tissues survives the life of the body as a whole. It is thus possible to transplant successfully such tissue from a corpse to a living organism.

- 2 The transplant must be endowed with the capacity for extracting nutrition from the soil into which it has been planted.

- 3 It must be able to regenerate so that the disintegrating tissue is replaced.

These properties are present very markedly in the malignant tumors and in cultures of living cells, as shown by Harrison, Carrel, and Burrows.

Even in tissues rich in the above mentioned qualities, it is important to know by what factors they are influenced. In removing and implanting the graft, many factors can easily enter which either weaken or destroy these properties, as drying, chemical contact, or mechanical injury. The practical surgeon who guards against such factors achieves the best results.

As important as the properties of the transplant are the qualities of the "wound soil" which serves the function of supplying as quickly as possible nutrition to the graft. The first step in the establishment of the lymph flow and the circulation is the early adhesion between wound edges and the transplant. The more quickly and surely this takes place, the more promptly is nourishment assured. Should the cells of the wound be injured because of antiseptic applications, or should they be abnormal because of the presence of scars or hæmatomata, or the seat of previous disease, as tuberculosis, necessary nutrition will be delayed. Very important contributing factors to failure are errors in operative technic, causing infection with a very slight transudate, which is instrumental in destroying the first intimate contact, thus preventing nutrition, partially or absolutely, and predisposing to partial or total necrosis due to suppuration. By means of strict asepsis, this element of failure can be eradicated. Most important, however, is a second factor, which prevents the early intimate adhesion of the wound edges, namely, imperfect hæmostasis. The presence of the slightest amount of blood is dangerous, as it interferes with the nutrition. That this factor has been heretofore disregarded is apparent from the literature. It is the general belief that a smooth, uninfected wound is a sign of perfect technic. This is not true in connection with transplantation. In this instance perfect technic is recognized by a complete gumming and coaptation of the wound edges. For this reason every experimenter in recording the results of his transplantations should convince himself that the transplant is really grafted as it should be, in order that his operation be perfect.

In order to perform transplantation the following rules must be observed:

Strict asepsis, complete hæmostasis in the wound, care in removing, handling and implanting the graft. To this add my rule—the improvement of the nutritive properties by prevention of suture lines, by placing flaps or small pieces of subcutaneous tissue or skin immediately over the graft.

During the after-treatment functional dressings, as advised by Roux, are important, as weighting of bones, stretching of tendons.

SKIN AND EPIDERMIS TRANSPLANTATION

The technic is well known and various methods are applied toward the common end. It is only necessary to emphasize that 'in my experience where there is present granulation tissue it is better razed with a knife than with a spoon, not interfering with the recent necrotic tissue. Not only do I believe this to be a better procedure, but I make it a rule never to plant epidermis on granulation tissue without previously freshening the base. To secure hæmostasis, I adopt the following procedure after ligation of the visible bleeding vessels, I allow the wound to remain uncovered until there is visible fibrin formation. Then I exert pressure over the surface with a gauze sponge moistened with warm saline solution. As a result all bleeding is brought to a stop, so that the capillaries come in intimate contact with the grafted flap.

The application of strips of epidermis to repair large areas of skin wounds is made possible—especially where prevention of scar formation is sought. This is of importance on the face and about the joints. The indications for epidermal transplantation are of less importance in those regions of the body where the skin contracts or where it cannot be closely fitted, with consequent disability or disfigurement, as on the scalp, forehead, or flank.

Substitution of epidermis for mucous membrane is not practical, since infection and secretion interfere with the healing processes. In the body cavities it has been tried without success, as in the repair of dural defects.

The successful epidermis transplantation terminates in healing with a smooth, pale, and soft skin surface. Uncommonly, one observes a scar-like thickening of the corium with ugly swellings and intense hyperæmia. This is found following the freshening of old wounds, and, in my opinion, in the tuberculous and in those susceptible to keloid formation.

Where epidermis is contra-indicated on account of previous cicatrization with shrinkage of the skin, transplantation of the skin finds its usefulness. Skin transplantation dates back to the Indian times, but its usefulness was first brought to notice in the last century by Bunger (1818), Wolfe, v Zehenden, v Langenbeck, and v Esmarch, when the importance of mechanical sterilization was recognized and finally emphasized by the work in strict asepsis of Fedor Krause. Here also I will not go into detail regarding the technic, as it is well known.

It makes no difference whether one follows Krause, in removing

the flap without fat, or v Esmarch, in using the fat with the flap According to Hirschfeld, healing takes place as well with or without the subcutaneous adipose flap Finally, as I brought out, I made use of padded flaps, as in the repair of facial skin

For successful healing to take place, the primary adhesion of the flaps is essential Should this intimate contact and glueing be disturbed within the first twenty-four hours, on account of bleeding or inflammatory transudate, death of the flap usually occurs, followed by marble-like areas and cicatrization as a final result I have, on some occasions, seen this occur after primary adhesion in cases of post-operative erysipelas, scarlet fever, or measles

To obtain a successful result, all pre-existing scar tissue must be removed from the surface of the wound, in order to prevent contraction of the flap

Attachment of the skin occurs more slowly than that of epidermis, the former occurring in from three to five weeks, the latter in one to two weeks Sensation manifests itself in the edges after about six weeks Transplanted hair sheds, regenerating only rarely Transplantation of hair flaps, for example, of the scalp, the pubic skin, or the axillary skin, for the repair of the eyebrows or upper lip, is not attended with certain cosmetic results

Like the hair, finger-nails with the contiguous skin do not lend themselves to successful transplantation, as Nicoladoni first demonstrated Even with favorable nutrition of the nail bed, the shape and the growth are abnormal

The advantage in the use of strips of epidermis over skin flaps lies in the certainty and rapidity with which repair takes place If all precautions are observed, healing occurs in every case of epidermis transplantation This certainly does not pertain to skin transplantation, but failure is not always due to faulty technic In some individuals failure is due to some factors not yet clearly understood I believe, as the result of my clinical experience, that there are patients in whom, after skin transplantation performed with strict observance of all rules, absorption of the flap with scar formation occurs, or in other instances, necrosis and suppuration with shedding of the flap, there remaining only a few small islands of skin These results have been noted mostly in the anæmic, in the tuberculous, syphilitic, or diabetic, while drying of the flap occurred mostly in those of advanced age

The advantage of skin flaps over epidermal strips rests in the greater resistance of the former, since it contracts less and affords a

better cosmetic effect For this reason I prefer to use skin flaps on the face and fingers

The important indication for skin transplantation is in the repair of skin defects Within the body, *ie*, for the repair of peritoneum, pleura, or capsule of joints, skin flaps are not useful The sequelæ usually consist in epithelial cysts and tumors, following encapsulation of the detritus mass of the absorbed epithelium and secretions

Independently of one another, Lowe and Rehn conceived the idea of utilizing the connective tissue of the skin as a substitute for the repair of fasciæ and tendons Later, following Lowe's observations, it was found that by abrading the layer of epidermis much detritus was formed, especially from the deep sebaceous glands and hair follicles Rehn's idea seems better, *ie*, to stretch the flap by means of artery clamps and to remove the epidermis with a knife Should broad skin flaps be needed, as from the upper portion of the thigh, the epidermal layer is first removed with a transplantation knife, the cutis and subcutis being obtained by a second incision This layer is then implanted on the recipient soil As Rehn has demonstrated, very large and broad tendons and bands and many connective-tissue areas can be repaired with the abundant material that can be obtained from the edges of wounds made on the operating table I have been able to use this material for padding out the tip of the nose and the *alæ nasi*, as well as to utilize the skin of the arm to build up an entire auricle, constructing a solid elastic plate

These favorable results in epidermis and skin transplantation have been obtained only in autoplasty Regarding the value of homoplasty, the conclusions are still uncertain As the result of clinical observations and animal experimentation, I am compelled to say that homoplasty does not yield good results And the reports in the literature of fortunate healing of transplanted skin or epidermis by homoplasty, as well as the reports of implanted skin or epidermis from the dead body or from animals, are the result of erroneous observation

This remark also holds good for the reports of successful transplantation of negro skin on the Caucasian, or *vice versa*, as I believe that the pigmentation occurring in the former case is the usual pigmentation seen after ordinary transplantation, and the light color seen in the negro is due to the scar, which in the negro is never pigmented In the light of our present knowledge, the status of homoplasty and heteroplasty can be summed up as follows

Histologic evidence which shows proof of healing has not been brought forward Clinical evidence has been offered, but this evidence

is misleading. Healing has been accomplished by replacement of the flap with normal skin, or the flap has been lifted away by the secretions of the sebaceous and sweat glands at the borders of the defect, with new skin growing under the raised flap. This has been interpreted as successful transplantation. Others have observed that in heteroplasty, for example, of hair or chicken skin with feathers, these skin accessories have grown but for a short period of time. De Francesco has noted the appearance of small feathers, and Perinoff has observed the growth of hair for twenty days after homoplasty. As a result of animal experimentation, Davis allowed himself the conclusion that homoplasty was equal to autoplasty, after Marchand, Henle, Wagner, etc., had expressed themselves against it.

In order to clear up this aspect of the subject, I suggested a number of new animal experiments (Oshima), and for many years have conducted many homoplastic dermal and epidermal transplantations with fresh human material. This was done in operations where the opportunities offered themselves, as in amputations of limbs. In all cases the wounds were covered with strips of skin, care being taken not to allow them to come in contact with the wound edges, and side by side with the homoplastic flap were placed autoplastic flaps of either skin or epidermis. By this means both types of tissue were subject to identical conditions.

While there was noted degeneration of the skin flaps with scar formation in the animals, the clinical experiments were also negative. In the clinical failures, however, not only was the flap shed, but it was shed in a striking manner, with acute gangrene.

Second, shedding of the transplant occurred as the result of a thick pus layer, which originated from the exuberant granulation of the wound—this being noted after apparent adhesion and healing in from one to three weeks. Perhaps an attempt at nutrition took place after an initial adhesion but was prevented by the formation of granulations. The entire process is suggestive of that which occurs in foreign body suppuration and shedding.

The third method of shedding is noted when, after the third week, following apparent healing, liquefaction of the dried epidermis or skin flap occurs without pus production. As in scab healing, the liquefaction occurs under the necrotic flap, when the floor of the wound has been covered with new skin. It is true that the latter appears under the protection of the flap but it is created by the body tissue, namely, from the cell rests of the skin and from the edges of the wound of the recipient.

Formerly, a frequent observation was the appearance, during or after the fourth week, in an apparently well-healed skin flap, of strange, red, scaly areas in the epidermis resembling pus. As the flap contracted because of cicatrization, these red areas became larger and changed their positions in the scar tissue. It became macroscopically evident that one dealt with production of granulation tissues scattered throughout the flap, as with the mechanical motion this tissue would bleed. Microscopical examination of the above described skin flaps showed this structure up to the forty-fifth day. This scar formation, I believe, is the best possible result, excepting scab formation (natural substitution), that one can obtain from skin homoplasty.

I obtained favorable results only with epidermal flaps from the fresh foetus. Here was seen plainly enlargement of the epithelial islands after the superficial layers desquamated. In spite of this attempt at regeneration from its own resources, the entire flap was cast off in the third week. Exactly similar results were obtained by Stern in his experiments with the amnion.

After these experiments I regard the usefulness of homoplasty in extreme doubt, and believe that the above-mentioned conclusions are the results of faulty observations, and the new skin formation, interpreted as implantation, is the result of scar substitution under incrustation of the flap. This does not exclude the fact that the foreign epidermis acts as a stimulant to the proliferation of the cells of the recipient. There is even greater doubt of the possibility of skin transplantation from the corpse, as reported by Gluck.

The inherent virtues of the homoplastic transplant are important factors in this consideration, since the structure of the donor's cell protoplasm undergoes early softening, resulting in healing by substitution with scar formation. I have proved clinically that racial differences play an important part, by using the skin from a freshly amputated limb of a Slav and implanting it on other individuals. In a Prussian, suppuration followed, while in a Slavish child healing with scar formation occurred. The most possible favorable result was met with in like races. More encouraging results were reported by Schone in transplantation in animals that were blood relations, since skin flaps could be easily interchanged between near relations of like sex. In the human family I have never applied homoplasty that was not free from subsequent objection.

There is no question that it is of clinical importance, if it were possible to prove the conclusions which have been advanced relating to the successful grafting of homoplastic flaps of skin, and if it is true

implants it in the previously prepared wound, in which there is complete hæmostasis. And if the rule is followed that the transplant does not lie directly under the suture line, one can obtain excellent results, even when large flaps are transferred.

The clinical application has proved of value in numerous instances.

1 To pad out depressions of the face, for example, after comminuted fracture of the frontal bone, in which case an incision is made at the hair line, the skin is dissected away from the underlying scar tissue, and the fatty pad is inserted.

Defects after breast amputation can be likewise repaired provided the skin is in good condition. Filling out of the orbit after ocular enucleation has also been successfully performed.

2 Plugging up of bony cavities, the result of repeated operations for chronic inflammation, instead of leaving ugly bony packing, has been successfully accomplished by Chaput, Potherat, Makkus, and others. Hesse substantiates these good results. The implanted fat attaches itself to the fibrous tissue, which apparently is scattered throughout the bone. From my experience more rapid, more certain healing without sinuses occurs after this method than after the use of iodoform gauze packing.

3 To prevent adhesions. In this connection, from my own experiences, fat transplantation plays a very important rôle. Fat insertion to prevent rigidity of joint after operations for ankylosis succeeds with best results in the loose joints of the arm, although favorable results have also been obtained in the hip and knee (Murphy, Lexer, Ropke). In operations on the knee, fat pads prevented recurrence of fixation of the patella. Likewise, fat implantation on the freshened acetabulum has relieved the ankylosis of congenital dislocation of the hip due to hemorrhage (Lexer). What changes take place in the flap of fat introduced into the joints is not known. There was no sign of the oft-mentioned watery-like fluid. Whether or not it will make its appearance later I cannot say.

In progressive myositis ossificans, the only improvement I could obtain was increased range of motion by resection of the larger bony nodules and filling in the dead spaces with fat tissue.

I obtained marvellous success in protecting nerves and tendons by means of "areoloplasty" in preventing adhesion (Eden, Rhein). In this field the greatest successes have been achieved.

Extensive clinical investigations have demonstrated to me the value of fat implantation in brain surgery. In spite of the numerous plastic materials that have been tried to remedy dural defects, none serve so

One cannot expect satisfactory healing in every case, as the condition of the wound may not be favorable for implantation after the injury, since it is then the seat of scar tissue. The conditions of the soil are even worse in congenital defects. It is an absolute necessity to prevent the flow of urine over the graft for some weeks by means of a bladder fistula.

Mucous membrane homoplasty, in the experience of Axhausen and myself, yields no better results than those described under the skin. Legeuer and Tanton report successful transplantation of vaginal mucous membrane to repair the urethral defect of a male, but admit that sound dilatation was needed, and that six months later (the present time) sounds are still being used.

The field of usefulness of mucous membrane transplantation is not large. One must have recourse to the use of pedunculated mucous membrane flaps when large defects are to be repaired, as in the mouth, cheek, or bladder, or to pedunculated flaps of skin for others.

FAT TRANSPLANTATION

Fat transplantation was attempted with success by Czerny in 1893, when he implanted by autoplasty a lipoma on the wound surface following a breast amputation, thus substituting the lipoma for the breast tissue. Axenfeld, Neuber, and Bier also tried a similar procedure with small pieces of fat.

The first transplantation of large flaps of fat, as well as the therapeutic application of this procedure, was originally worked out by Lexer. He has demonstrated the first successful result, in a case where he padded out a sunken cheek with fat, following fracture of the angle of the jaw, three years after operation.

Rehn arrives at the following conclusions regarding the histology of the fat flaps transplanted by homoplasty and autoplasty.

After autoplasty part of the transplanted fat tissue remains unaltered, in the remainder, changes as found in homoplasty are observed. In spite of pressure atrophy, cell infiltration, and cystic degeneration, the embryonic fat cells, some arising from the older fat cells, others attached to the connective-tissue fibres, emerge as victors and regenerate. In homoplasty this process is exceedingly long drawn out. While there appears, after fifteen days, vigorous fat tissue in autoplasty, in homoplasty the constructive and regenerative processes are still in their infancy.

One takes the flap or pad of fat to be transplanted together with the subcutaneous tissue, being careful not to squeeze or tear it, and

FREE TRANSPLANTATION

as do other tissues used for the same purpose, as, for example, segments of fresh veins, but there appears to be no advantage in using them. In order that other nerves are not injured, homo- or heteroplasty must be practised. Noteworthy reports have been recorded by Durour in heteroplasty.

Practically, we can in many cases of injured parts of muscles or where muscles as a whole have been destroyed, make use of transplantation by means of a pedicle, and, in the case of nerve defects, of other tissues as above mentioned. In those instances where entire muscle groups and nerves have been destroyed, muscle transplantation would be the ideal method of repair.

VESSEL TRANSPLANTATION.

Vessel transplantation has been made possible by the perfection of the blood-vessel suture (Carrel, Stich).

The first attempt was made by myself in 1907, when I resected an aneurism of the axillary artery and set in a section of the saphenous vein. The operation in itself is not difficult, but great care must be exercised in handling the graft, as the slightest injury predisposes to thrombosis.

Indications for vessel transplantation in arterial defects occur after resection for aneurism, removal of large arteries with tumor masses, especially where it is imperative that the circulation must be maintained. This is always the case when there are present conditions which militate against the establishment of collateral circulation, as arteriosclerosis, hemorrhagic infiltration, and cicatrization. Since autoplasty here deserves precedence, and one cannot employ the segments of other arteries of the patient, the saphenous veins must supply the grafts. The dangers attending ligation of the arteries of the arm or leg or common carotid will be minimized, in a certain percentage of cases, where there are present hindrances to the establishment of collateral circulation, if the surgeon can attempt to replace the arterial segment with one of vein.

The value of vessel homoplasty lies in the fact that healing and replacement take place only from the inherent blood-vessels and connective tissue. Thrombosis is of frequent occurrence. With heteroplasty no better results have been obtained.

Vessel transplantation is applicable for

- 1 Replacement of arterial deficiencies as described
- 2 Attempts have been made to repair congenital and acquired defects of the urethra by insertion of segments of fresh saphenous

well as fat tissue, especially when the pia is scarred, or is injured during the operation, or, when there exists also brain injury in the immediate vicinity of the dural defect. No graft, be it peritoneum, fascia, or fat tissue, can be implanted on the abnormal pia without the subsequent formation of adhesions or scar tissue. The transplant attaches itself to the injured pia, as it does on the bony side, but a thick flap of fat acts as a bolster and prevents the growth of tough, injurious scar tissue between the brain substance and the calvarium, at the same time effecting a complete closure of the subdural space (Rehn). This in my opinion places free fat transplantation for the repair of dural defects with co-existing brain injury or a pathological pia, as the method of choice before all other operative methods.

I have also had the experience to place a fat pad in a brain defect due to an open, dilated ventricle, closing the opening with a flap the size of a fruit plate. At the same sitting a skull defect was repaired with a bony graft, necessitating the healing together of two foreign tissues.

TRANSPLANTATION OF MUSCLE

Muscle is not favorable tissue to transplant by autoplasty, since it soon deteriorates because of insufficient nutrition. Even if, following the suggestion of Jores, the muscle is frequently stimulated by faradism, the end result is cicatrization because of the absence of the necessary nerve attachments. Success is not constant, even if the muscle be transplanted with its main nerve, so that it receives its impulses from the central nervous system. The possibility, however, of such transplantation was demonstrated by suturing the nerve to another nerve-trunk. The faradic current must be employed to exercise the functional powers, after such conductivity has been established.

Investigations by Wrede and Stiassing along these lines yielded negative results, while Gobel ascribes success to stimulation of the regenerative powers of the defective tissue rather than to the transplant.

It is very convenient at times, when there is a scarcity of fat tissue, to utilize pieces of muscle for packing bone cavities. Implantation is attended with as little irritation as when fat is employed.

NERVE TRANSPLANTATION

The reasons submitted as against the successful transplantation of muscle hold good for successful nerve transplantation. Transplantation of nerves can be utilized for bridging over defects, and they act

FREE TRANSPLANTATION

as do other tissues used for the same purpose, as, for example, segments of fresh veins, but there appears to be no advantage in using them. In order that other nerves are not injured, homo- or heteroplasty must be practised. Noteworthy reports have been recorded by Durour in heteroplasty.

Practically, we can in many cases of injured parts of muscles or where muscles as a whole have been destroyed, make use of transplantation by means of a pedicle, and, in the case of nerve defects, of other tissues as above mentioned. In those instances where entire muscle groups and nerves have been destroyed, muscle transplantation would be the ideal method of repair.

VESSEL TRANSPLANTATION,

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1. Replacement of arterial deficiencies as described
2. Attempts have been made to repair congenital and acquired defects of the urethra by insertion of segments of fresh saphenous

vein The results varied, due partly to unsatisfactory hæmostasis, and partly to coincident inflammation It is not necessary to divert the urinary flow by means of cystostomy, as when an appendiceal graft is employed Possibly this is due to the early adhesion of the adventitia to the walls of the wound Constriction does not always follow, due to contraction and narrowing, and can be prevented by the use of sounds Occasionally a mucous membrane covering is provided by the mucosa of the urethra

3 Repair of ureteral and gall-duct injuries have been attempted by Makkas, Tietze, and Floercken without great success Failure has been due to immediate utilization of the tube for urinary or biliary flow, which could be prevented only by nephrotomy or drainage

4 Vessel transplantation is of value to bridge over defects of tendons or nerves In the latter instance it is of the greatest value even in homoplasty, while I have long since abandoned insertion of vein or artery segments in the former, since free tendon grafts yield far better results and are more serviceable

5 Henle and Payr have made use of vessel segments as drainage tubes in hydrocephalus, to direct the ventricular secretion into the venous circulation

6 Koenig used fresh pieces of vein to protect uncertain suture lines, as, for example, in the urethra

TENDON TRANSPLANTATION

The thought that tendons are amenable to transplantation by auto- and homoplasty occurred to me in 1907, when I noted how well they healed after my first knee-joint transplantation This served as a stimulus to undertake the clinical and experimental investigation of tendon transplantation The conclusions of my assistant, Ed Rehn, which are of importance, follow

The implanted segment of tendon heals,—even in homoplasty,—but marked differences in its properties are noted, dependent upon whether the part is immobilized or early motion is permitted In the former case, adhesions occur, the segment is invaded by fibrous and scar tissue, so that it is tightly bound down, while early stimulation by motion results in the growth of a strong tendon, and regeneration is aided by the early appearance of blood-vessels along the suture lines In no other part of the body does early functional stimulation play so important a rôle

As the result of my clinical experiences, application of tendon transplantation is feasible in the following

1 In the repair of torn ligaments, autoplasmic and homoplasmic insertion of tendons is attended by success, as, for example, in the patellar ligament, deltoid ligament accompanied by fracture, while repair of ventral hernia is possible if the fibres are laid in the same direction as the original tissue

2 Tendons can be substituted for muscles for the cure of paralysis, or tendons can be replaced or strengthened in this way, or especially in defects of the tendons due to neglect, misplaced sutures, or where supuration with necrosis of the tendon sheath has occurred. In these cases autoplasty with fresh tendon segments gives natural and most favorable grafts. These operations must be followed by passive motion.

Healing with resultant motion is attained by tunnelling out the wound, removing only small sections at a time, in order that the insert be not covered by a long suture line and consequent long scar.

My experience has been as follows

If the tendon defect in the finger is covered by a large long scar, as is usually found after abscess of the tendon sheath, the adherent tendon must be liberated, and the cicatricial tissue must be removed down to the bone and capsules of the joints, after which the whole wound is covered with a pedunculated or free skin flap. This is then followed by the tunnelling above mentioned. If there is present deformity of the finger, due to suppurative necrosis of the flexor tendons, a small oblique incision is made over the inner side of the palm, down to the adherent tendons, and the latter are freed from the scar tissue and stretched. The skin is then raised by means of an elevator to the tips of the fingers while they are held extended. After the tendon graft has been firmly sutured to the flexor profundus tendons it is guided through the canal with a small sound to the finger tips and there sutured to the subcutaneous fat close to the bone. In order to obtain an ideal result, so that the graft is attached to both phalangeal joints, another segment is sewed to the stump, and guided through the canal to the middle phalanx, where two small lateral incisions are made and the distal extremity is sutured deeply, under protection of the nerves and vessels.

It is a simpler matter to implant the extensor tendons. Where multiple tendons are to be repaired, it is necessary to build up a skin flap. If primary union occurs within a week, active and passive motion is instituted and continued as long as is necessary.

After mobility has been obtained after transplantation of the flexor tendons, one can apply transverse bands about the joints to hold the tendons in place, or a like result can be accomplished by having the

patient wear a ring, so that when an object is grasped it presses against the ring (Rehn). In this way the profundus is brought into action strongly. A procedure that yields good results is a transverse bridging of the skin over the median joint, *i.e.*, two long pedunculated skin strips are placed crosswise over the joint. The scar between the flaps should lie immediately over the normal skin fold of the joint. This bridging acts just as does the transverse band, in that it allows bending of the tendons. In cases where there existed no previous ankylosis, or where the bones had not suffered extensive injury, we were rewarded with satisfactory results (Rehn). When ankylosis of the phalangeal joints is present, it must be remedied by insertions of fatty flaps before the tendon repair is begun.

Tendon transplantation is also of value for lengthening tendons, where muscular deformity has occurred as the result of contraction, as after ischæmic paralysis in the forearm. After the tendons have been divided, and the deformity of the fingers has been corrected, insertions are made into the defective flexors. In children with thin tendons, I lengthen the tendons by a Z-shaped incision.

The source of the material for this form of transplantation is easily accessible, but not always available. One can remove without harm the tendons of the palmaris longus by making two small tenotomy incisions. Also, the extensor tendons of three to five toes can be utilized without disturbance to the function of the foot.

Tendon homoplasty is apt to cause adhesions because of the irritation of the foreign tissue, for which reason it is more useful in the repair of ligaments than for freely movable tendons.

FASCIA TRANSPLANTATION

Fascia transplantation is similar to tendon transplantation. To Kirchner belongs the credit of the original experimentation and clinical proofs in this field. The indications are numerous: repair and strengthening of ligaments and capsules of joints, repair of tendons and dura mater, reinforcement of suture lines as in large hernia (Konog, Hohmeier), building up of aponeuroses for the transfer of muscle function, as in the frontal muscles for ptosis, application of fascial flaps between articular surfaces after post-operative injury to the synovial membrane, in mobilization of joints, as a base for hæmostatic sutures in organs, suspension of the pylorus at the site of excision (Wilms). Attempts have been made to utilize fascial flaps for large defects of the pleura, the diaphragm, or trachea. They are not of practical value for the replacement of tendon or nerve sheaths, since dense adhesions are formed (Goldmann).

FREE TRANSPLANTATION

The source of the material is the fascia lata, with its strong fibres from the outer side of the thigh. Homoplasty carries no advantage over autoplasty, because of the availability of the material. According to Rehn's experiments on animals it is practically possible.

PERIOSTEAL TRANSPLANTATION

In 1859 Ollier attempted periosteal transplantation, and later investigators have confirmed Marshaud's findings, that periosteum belongs to that class of tissues which permit implantation, and that it pursues its function of bone production provided that the soft medullary tissue does not come in intimate contact with bone.

Its application is like that of fascia, exclusive of tendons and ligaments. Periosteal flaps inserted between torn synovial membranes of the elbow-joints have acted well, according to Hofmann. Fractures have been enveloped with periosteal flap to increase callus production.

Practically, autoplasty has been proved, and homoplasty is not far behind, since we know the bone producing property of periosteum that has been transplanted together with bone.

PERITONEAL TRANSPLANTATION

I first attempted implantation of peritoneum for the repair of a dural defect, acting upon a suggestion from Kocher. Normal peritoneum was not used, as a hernial sac and a hydrocele sac were at hand. Adhesions resulted, just as they did in attempting to build up a new capsule about a knee-joint. According to Drandt, the use of peritoneum to repair dural defects with normal underlying pia, whether it was implanted on the inner side or the outer, or even if both layers were employed, resulted in the same way. Kolaczek, however, in implanted peritoneum over normal pia, noted few or no adhesions.

I question the value of repair of dural defects with peritoneum, fascia, or periosteum, since the underlying pia is usually injured, cicatrized, or necrosed, and dense adhesions follow between the skull and brain. For this reason, as above mentioned, I prefer the method of fat transplantation, since the graft acts as a pad and prevents areas of adhesions.

Transplanted omentum is liable to adhesion in the free peritoneal cavity, as shown by Springer. It, therefore, is an excellent material to use for the repair of injuries of the intestinal wall not accompanied by perforation or to strengthen the suture lines in gastric surgery (Sabaki).

BONE TRANSPLANTATION

In the art of transplantation, bone implantation is the most ancient, in point of knowledge and practical use, it is more important than even skin transplantation

In the interesting history of bone transplantation, the following facts are worthy of mention In 1809, Merrem obtained successful healing of bony plates in the skulls of animals after trephining Later Walther, in applying these experiments to man, obtained partial healing in spite of coincident suppuration Ollier then, in 1858, attempted with success bone transplantation in animals and in man and worked out its applicability

The conclusions of Ollier consisted in the fact that fresh bony tissue covered with its periosteum remains viable, that denuded of periosteum it necroses and acts like a foreign body, becomes absorbed, and is replaced by bone only because of contact with the osteogenetic walls of the wound

Dead bone, *ie*, macerated and boiled bone obtained from the cadaver, or fresh bone which has been sterilized, lends itself to transplantation, but it acts as does a foreign body, which slowly undergoes substitution, it is rapidly destroyed by vigorous granulations, by means of a "gnawing" process Foreign body suppuration with extrusion of the dead graft, long after primary union, occasionally occurs Likewise bone transplanted from animals, as, for example, that of the dog, is tolerated by man Kuttner obtained good results only with bone of the ape I obtained union of segments of long bones, *ie*, in the defective bone, only when the periosteum of the recipient was intact Homoplastic and autoplasmic transplanted bone will heal without partial absorption only when the fresh graft is transferred with its medulla and periosteum

The function of the graft and its covering lies in the fact that it replaces the missing tissue and enables the body to build up new bone For this purpose the transplant is endowed with long life and vigorous powers of regeneration, and the implanted graft retains its shape until the edges of the recipient's defective bone regenerate, in spite of the fact that the implanted bony tissue disintegrates and becomes necrotic as Marchaud, Barth, and others have established

A further advantage in including periosteum is that it aids in the cementing of the graft to the wound edges and stimulates invasion by blood-vessels, thus establishing early nourishment

These clinical conclusions have been substantiated in many respects by histological investigations Barth recognized the fact that

included periosteum plays an important rôle in transplantation, and later experiments by Axhausen, Frangenheim, and others have demonstrated positive proofs in this respect

As Ollier has shown, the best material to use for bone transplantation is the bony tissue, including the medulla and periosteum. Autoplasty, concluding from our experiences, is the method of choice, and one does not find any difference whether the graft is implanted as one piece or in fragments. Necessary substitution can take place only through the agency of the implanted elements of the periosteal and medullary layers. In fragments of bone transplanted by autoplasty this occurs in a lessened degree. Petroff, experimentally, found a distinct difference in homoplasty and autoplasty in that substitution took twice as long in the former. It is certain that the best form of healing, together with survival of the bony tissue, with slow absorption and equal regeneration by means of the inherent elements of the graft, occurs usually with autoplasty, and, furthermore, that the application of large denuded (of periosteum) living pieces of bone—equally in auto-, homo- and heteroplasty, or with the use of dead bone—when imbedded in bare (not covered with periosteum) spaces, is accompanied by so rapid an absorption that substitution cannot keep pace with it, so that the continuity of the entire piece becomes broken.

Clinical success, therefore, in the repair of large denuded bony cavities, can be achieved only by the use of living bone covered with periosteum. Should, however, the periosteum of the recipient be intact, it is immaterial what method of transplantation is employed, as the respective graft heals as does a foreign body, and is soon replaced by the periosteum of the defective bone, in fact often thickened.

In spite of this, preference should always be given to the living homologous bone, as the foreign body, which irritates the periosteum and thus stimulates its bone formative processes, otherwise soon disintegrates. By autoplasty skull defects can be repaired, with periosteum covered plates obtained from the outer table nearby (repair of skull defects, Lexer). In children, where the skull is so thin that even pedunculated, skin-covered flaps cannot be removed, periosteal bony flaps may be transferred from the tibia. Ropke suggested resection of a portion of the scapula for the repair of skull defects, in order that the graft be covered by periosteum on both surfaces. For smaller defects, those concerning the small bones as, for example, of the carpi, or for the repair of saddle nose, rib resection can be performed. The fibula yields good fragments without periosteum. Large, broad fragments can be obtained from the anterior portion of the tibia. the cavity

naturally healing from the medulla (Bier) Entire phalanges of the toes permit of transplantation into the fingers (see joint transplantation) Autoplastic material is scarce In homoplasty use can be made of amputated limbs which are not the seat of inflammation or malignant growths (serious injuries, dry gangrene, dry diabetic gangrene)

The field of usefulness for free bone transplantation is large Only the most important indications are mentioned

1 Repair of cavities in the cranial bones One or more segments of the external table covered with periosteum are transferred from the immediate neighborhood The cortex of the tibia or a portion of the scapula also is available In the latter, it is of advantage, as the fragments are surrounded by periosteum

2 Filling in of sunken spaces in the face In saddle nose, in sunken spaces in the forehead following operation, or in bony defects due to tuberculous osteitis of the facial bones, in recession of the superior maxilla due to hare-lip, after the soft parts are raised, small fragments of bone may be imbedded

Bony plates may be imbedded in the skin of the arm, later to be transferred for the repair of nasal and facial defects, as recommended by the Italians

3 Repair of defects of long bones and the inferior maxilla In the long bones, even when the periosteum is destroyed, large defects can be repaired, coincident with amputation Only one needs fresh amputation material in order to obtain bone of sufficient thickness Since such extensive defects are, as a rule, the result of operative interferences for centrally situated sarcoma, successful repair does not always follow If a graft is not at hand, contraction of the defect can be prevented by the insertion of pieces of ivory or horn, and later fresh periosteum covered fragments can be substituted

Where the above substitute is not used, and contraction of the soft parts occurs on account of bands, care must be observed that cicatrization is prevented in the wound intended for the transplant, since, owing to the deficiency of blood-vessels, nutrition is interfered with Cicatricial tissue also prevents the formation of a strong callus on the part of the recipient, as it is necessary that vigorous growth occur into the graft In defects of the long bones, long pieces of thin transplant (fibula or femur) have been utilized, being selected because of the functional obligation of the limb to carry the weight of the body In the arm, on the other hand, thicker segments are indicated, since they become thinner and disappear For this reason, in defects of the long bones of the arm where the periosteum is wanting, very thick fragments

should be imbedded For the shorter bones, where defects, as a rule, are due to tuberculosis or suppuration after injury, pieces of rib or fragments of the tibia (mostly autoplasmic) are useful

In repair of the inferior maxilla, free bone transplantation is applicable, but one has to deal with intercurrent infection of the wound from the oral cavity In 1908, I recommended the trial of transplanted fragments of ribs covered with periosteum, by homoplasty Several authors (Goebell, Dumont) later reported successful results by using rib segments or clasps of tibial fragments Secondary imbedding in the resection wound is naturally less prone to the danger of infection than primary However, on account of the situation of the lower jaw, the latter is more imperative

4 Fastening of bony fragments Fresh fragments of bone, particularly of tibia covered with periosteum from amputated limbs, or costal or tibial segments from the same patient, have been used by Lexer to fasten the fragments of old or recent fractures, especially of the neck of the femur One-half of the length of the transplant is forced into the medullary cavity of one fragment, the remainder into the medulla of the other fragment, of the fractured bone Should insertion into the latter be difficult, the medulla can be enlarged by splitting the shaft beneath the periosteum This "bone bolting" is useful in immobilization of the ankle-joint of the paralytic foot (Lexer), a canal being bored from the heel, through the os calcis, and astragalus to the lower end of the tibia This canal should not be made too wide, as the bolt must be inserted forcibly so that blood and detached marrow cannot collect between it and the bone, since bone will unite with the surrounding bony tissue only when it lies in intimate contact with it, otherwise granulations appear in the walls of the canal, interfere with nutrition and predispose to rapid absorption Some of the failures reported by authors are due to this technical error. It is a strange fact that this bolt stimulates thickening of the spongy portion of the bone, while it is absorbed in the upper ankle Therefore ossification rarely takes place in this joint, as a rule, only the necessary immobilization This procedure is simpler than the usual arthroplasty, and with proper care yields satisfactory and permanent results Bony bolts can be used in the place of nails to fasten bones, as after the resection of joints

Other applications of bone transplantation are the replanting of dislocated bony splinters, which must be removed on account of severe injury or pressure on nerves or vessels It has been attempted (Albee) to repair vertebræ, the seat of tuberculosis, by imbedding plates of tibia, or to fasten the vertebral joints after dislocation through the medium

of pieces of the spine of the scapula (De Quervain) Recently, Perthes reported the successful cure of flat-foot by means of bone transplantation The inner border of the foot is shortened by removing a section of the navicularis Osteotomy of the os calcis is done and the outer border of the foot is lengthened by driving the fragment of the navicularis into the incision in the os calcis

CARTILAGE TRANSPLANTATION

According to Marchaud, in cartilage transplantation the perichondrium plays the same part that the periosteum does in bone or the tendon sheaths in tendon transplantation, since it favors regeneration of the parts that tend to disintegrate Repair can also occur, as shown by Axhausen, by reproduction of the living cartilaginous cells, so that successful transplantation of cartilage does not depend entirely upon the presence of perichondrium, a fact that has an important bearing on the satisfactory outcome of implantation of articular cartilage

Since cartilage from the ribs is so easily available, it is, as a rule, unnecessary to resort to homoplasty, although it yields good results

Cartilage transplantation can be utilized for filling out sunken areas on the face, or for imbedding between the torn layers of the synovial membranes of the smaller joints, when other tissues, like fat, are not available For nasal repair, a small piece of costal cartilage forms a good tip A sunken tip can be raised by the insertion of cartilage into the septum In the repair of saddle nose, fragments of cartilage have the preference over bony segments, as they can be more easily fitted One may substitute pieces of cartilage for bone in the repair of phalanges, carpal or tarsal bones

The advantage of cartilaginous union over that of bony is problematical, since its properties, regarding durability and usefulness, are the same as those of periosteum and osseous tissue This fact is of the greatest importance in determining the future growth of transplanted (homoplastic) joints during the growing age (children) Experimental evidence leads to varied conclusions (Helferich, Enderlen, Rehn, Borst, Heller, von Tappeiner) The majority found more or less necrosis at the site of the union, with disturbance of the reproductive processes (in homoplasty) Heller found the greatest interference in homoplasty, less in autoplasty Rehn obtained very favorable results He transplanted by homoplasty the radial epiphyses of young guinea-pigs of the same brood, and demonstrated the endurance and the reproductive powers of the cartilaginous border

Even though the majority of investigators rule against the practical

application of cartilage transplantation, Kuttner was able to perform heteroplasty by transferring the fibula of an ape into a child, which one and one-half years later, under X-ray, showed complete viability of the epiphyseal line. In one case, in whom I performed homoplasty (repair of an ulna by means of the shortened fibula of an older child) two years after showed by X-ray adhesion of both cartilaginous areas, but disturbance of growth was not noted, although the central portion of the bone was completely absorbed.

Saer has accomplished recently, by means of autoplasty, substitution of the head of the fibula for a severely injured distal extremity of the radius in a child. This procedure is rather too recent to be commented upon.

No definite opinion can be given regarding the ultimate applicability of implantation of cartilage, because the number of operated cases have been small, and have not been observed for a sufficient length of time, and animal experimentation has given rise to varied results. At any rate one is dealing with a very susceptible tissue, since the slightest interference with nutrition disturbs its growth.

JOINT TRANSPLANTATION

Joint transplantation is the outcome of the work done with cartilage and bone transplantation. It necessarily follows that if one can perform homoplasty with *large segments of the long bones*, it is possible to transplant the bone with its articular surfaces.

The earliest experiment in this field was attempted in November, 1907. It occurred in a case of defect in the tibia involving the entire upper third of the tibia, including the articular surface, due to a central sarcoma. The former procedure in like cases was to engage the lower end of the femur into the tibia by boring, thus permitting of union between the bones with considerable shortening of the limb. In order to obviate the latter result, and, if possible, to restore the mobile functions of the joint, a similar portion of tibia was removed from a freshly amputated limb and implanted with its articular cartilage and periosteum.

Then the thought arose to advance a step further. If it were possible to achieve healing of this large segment of bone with its articular extremity, like success might be attained by transplanting the articular surfaces for the repair of joints.

This idea I carried into play on the same day, as I had at hand a freshly amputated limb, and had on numerous occasions attempted to use other tissues and lately, fat, to mobilize joints. After resection

of the synovial sac, the articular surfaces of the tibia and femur, with their attachments the crucial ligaments and the meniscus cartilages, together with the cartilaginous fragments of thumb thickness were dissected and implanted in their entirety over the previously prepared defect. The first method I called half transplantation and the second whole joint transplantation.

By half joint transplantation, I implied transplantation of bony extremities, utilizing their articular membranes as much as possible, while in whole joint transplantation I attempted imbedding of long bones with both articular surfaces. This work was successfully carried out by others (Kuttner, Rovsing, Wolff, Enderlen, etc.) as well as by myself.

The source of the material has been freshly amputated limbs. I have discarded the use of material from the fresh cadaver, first, because of the difficulty in obtaining sterile tissues from the morgue, and second, because fibrous encapsulation took place in one case of knee transplantation. It is another matter to utilize a limb or segment of bone from one who has met his death by injury, provided all the rules of asepsis are observed.

Kuttner has further worked out the utilization of the fresh cadaver, and reports successes in half transplantation. This author employed homoplastic material under great difficulties, and in fact performed heteroplasty with tissues in which the albumen is closely related to that of man, *i e*, from the ape.

Autoplasty is applicable only to the finger-joints, as the toes can be substituted for them. Shortly after my first report, Buchman reported transplantation of the toe-joint into the elbow, after having arrived at the same conclusions as I had. Judet coincidentally demonstrated limb transplantation in animals. Two specimens, the first being removed because the patient objected to the idea of carrying about the bone of another individual, the second because of the incidence of sarcoma, on examination showed the following changes.

The upper third of the tibia, implanted one and one-half years ago, which was healed into the knee with excellent functional results, showed spots of cartilage which had been isolated by areas of necrosis. The periosteum of the implanted fragment is thickened, and the fragment is firmly united to the bone of the recipient by callus. Osteogenesis is demonstrable from the periosteum. The cortex as well as the ramifications of the spongy layer is necrotic, at the site of the medulla there is present in the canals of the spongiosa fresh fibrous tissue, in the interstices of which there is bone regeneration. The articular cartilage

is in most part well preserved. The menisci are adherent to the capsule, as is the recipient's patella to the implanted tibial fragment.

The findings in the second case are similar five months after implantation of the lower end of the femur, except that there is present a spontaneous fracture due to the sarcoma.

The relation of the firm union of muscle, tendon, and ligament with the graft to restoration was noteworthy in these specimens, as well as in those of Kuttner. Clinically, there were no unfavorable sequelæ, excepting a fluid exudate in the knee of my first case. The limbs were soon endowed with normal function, the leg was useful in walking and standing without aid. X-ray after two to three years showed irregularities in the borders of the implanted grafts, exactly like the deformities of arthritis deformans.

Naturally, the long bones can be transplanted in their entirety with both articular surfaces. This does not as yet pertain to the large bones as it does to the smaller ones. After injury of a phalanx with loss of function it formerly was the custom to amputate, as it interfered with the other fingers. Now, one is able to obtain a phalanx from an amputated limb, as I first showed in 1907, or autoplasty can be done by removing a toe, or a segment of rib cartilage, or other fragments can be utilized. Others (Wolff, Sievers and Goebell) also report successful work in this field.

Finally, half transplantation is useful in replanting injured parts of joints after luxation-fractures, as of the head of the humerus, part of the lower extremity of the humerus (Lexer, Perthes, von Haberer). Here the favorable wound bed plays an important part, as hemorrhage, infiltration, necrosis and cicatrization prevent the rapid establishment of sufficient nutrition.

In whole joint transplantation, where both opposing articular surfaces are transplanted, it follows naturally, that the articular cartilage must lie within the capsule of the joint. It was therefore feared that fibrous tissue would originate from the surrounding tissue, invade the joint cleft, destroy the cartilage and hinder mobility. On account of this fact, I attempted in the first case after healing of the joint, to implant fresh hydrocele sac to act as the articular capsule. Of course, induration occurred about the graft, but as shown after re-operation, this in itself acted as a sort of capsule, and prevented invasion of the joint cleft by scar tissue.

Up to the present time progress in whole joint transplantation has been limited to the knee-joint. From a clinical stand-point, I can testify to complete healing in a knee-joint, six years after transplantation.

The X-ray shows transformation partially by means of absorption, and partially by means of excessive growth at the site of union, similar to the changes occurring in arthritis deformans, but motion and function are perfectly free and satisfactory

The joints are useful, because change in shape in this abnormal situation is prevented on account of its pre-existing form, and because mobility of the leg aids in this prevention

The mechanism of the new knee-joint is in no way normal, since there occurs no rotation on the condyles. In a normal sense, there is present a pseudo-arthritis, in which there occurs anterior gaping on motion. For this reason, I remove an elliptical segment of the thigh, and place on this the rounded portion of the stump of the femur. Thus, the patellar fascia of the transplant is anterior to the circumference of the condyles. This case, however, in spite of faultless healing and function, is of too recent occurrence to base any opinion on its permanence

The greatest difficulty following fortunate implantation lies in the restoration of the severely injured extensor muscles, which with the tendons are occasionally destroyed by intercurrent suppuration, or which because of long standing ankylosis have become atrophic and fatty

For this reason motion may be only passive, or flexion and extension may be restricted. Where the musculature is well preserved function is naturally more satisfactory than where operations are necessary to first restore the possibility of active motion

Following the transplantation of both raw joint surfaces successful healing occurs, and if the graft is properly fitted material capable of substitution is deposited. The implanted portions grow according to their inherent abilities, and the substituted material is not subjected to stiffening or shrinking, this fact being in line with animal experi-

kylosed joints are not equally suitable for transplantation
resection for tuberculous arthritis are subject to suppu-
remaining tuberculous foci, or due to weakening and
issues about the transplanted material
site of transverse scars, exerting traction on the
unsuitable for transplantation

only can be used for finger-joint transplantation by auto-
e can even attempt transplantation of the capsule in this
(Gobell), a method which resulted as a failure in my hands
lasty

Satisfactory material for transplantation is difficult to obtain, since the limbs of elderly individuals are the seat of atrophic fatty changes in the cartilages, or the more or less crippled joints are of low vitality and have poor regenerative qualities, being subject to rapid absorption and complete necrosis. These difficulties are the exception in total joint transplantation, since under favorable circumstances satisfactory results are obtained.

I have established the fact that good results can be obtained in restricted joints, by freeing the articular adhesions and implanting fat, fascia, periosteum or muscle. In the after-treatment, because of the tendency to contraction, one must institute early passive motion, while during the operation, care must be observed to prevent recurrence of stiffening, by means of sufficient articular separation. The latter, again, may be followed by abnormal lateral mobility.

Experimentally, it is extremely difficult to perform joint transplantation upon small animals, since the transplant is readily injured by handling, and especially because complete hæmostasis is difficult. The experiments of Judet, Wrede, Dalla Vedove, Dugung, Borst for this reason are unsatisfactory.

One cannot draw any conclusions on account of the difficulty of transplantation in small animals, from the occurrence of the total necrosis that is found. These failures demonstrated one fact, that success does not depend necessarily on the survival of the transplant. It has been shown in animals (Wrede, Judet, Axhausen, Rehn) and in man (Lexer, Kuttner) in support of this fact, the successful transplantation of bone and cartilage, and in the latter, preservation of cartilage, periosteum and bone marrow with osteogenesis. Of clinical importance is the property of substitution as established by Borst.

TOTAL LIMB TRANSPLANTATION

Transplantation of fresh limbs *en masse* has been attempted from various points of view, but up to the present time autoplasty only has yielded results, *i e.*, replanting of an amputated limb (Carrel and Jianu in dogs, Jianu in man, in whom there was not complete separation, in that the skin and veins remained uninjured).

The question of replantation of divided limbs comes up after severe accidents, but naturally, when the tissues are not macerated. Whether or not it is possible to replace an amputated limb by homoplasty, using one from the cadaver, remains to be seen. Until the outcome of this speculation is decided, it will be interesting to follow homoplastic limb

Autoplastic insertion of an arterial segment into a vein was followed by thrombosis, in the hands of Borst and Enderlen when performed on a dog

Homoplastic transplantation of artery to artery was first attempted by Hophner by planting the femoral artery into a resected carotid, and pulsation was demonstrated 45 days later, when the artery was exposed to view. This was done on dogs. Carrel, Stich and others also report good results. Microscopical examination of a case of Borst and Enderlen showed that growth over the suture line arose only from the intima and the connective tissue of the carotid stump of the recipient.

In man, Delbet attempted the above procedure. He wished to repair a defect, eight centimetres in length, of the femoral artery after extirpation of an aneurism, with a piece of femoral artery obtained from a coincident amputation of the thigh. As the artery of the donor was sclerotic, he was compelled to desist, and content himself with ligation of the femoral, because the sutures would not hold.

The first to attempt heteroplastic blood-vessel transplantation was Hophner, who transplanted the aorta of rabbits and cats into the femoral artery of the dog. Hemorrhage or thrombosis followed. These experiments were repeated by Stich in the clinic of Garre, in spite of the theory of Payr, vessel sutures were employed. The first attempt resulted in an astonishing success, following implantation of a cat's aorta in place of four centimetres of a resected carotid of the dog in which autopsy *in vivo* after fifteen days demonstrated pulsation as in a normal artery. Further transplantation of cat's and rabbit's aortas into the resected carotid of the dog after 51 and 52 days, was attended with good healing and function. A segment five centimetres long of the posterior tibial artery, obtained from a freshly amputated leg of a man, was successfully transplanted into the carotid of a dog. The observation period was only fourteen days in this case. Of six heteroplastic transplantations, half were successful. These positive results were soon confirmed by Carrel. He transplanted the segments of the carotid or the jugular veins of dogs into the resected aorta of cats. In three out of five cases the suture lines broke down, while in the fourth case, six days after the above-mentioned extirpation, there was demonstrable functional result. In the fifth case, exploratory laparotomy showed good pulsation in the aorta and in the transplanted carotid segment, and 78 hours after the operation the condition of the animal was good and there was vigorous pulsation in both femoral arteries. Ward, also, sutured a piece of the aorta of a rabbit into the carotid of a dog, up to the seventieth day the functional result was

good Borst and Enderlen performed two heteroplastic transplantations from the cat to the dog and from the goat to the dog. In the first instance, examination 74 hours later demonstrated between the obliterated suture lines of the carotid stump a thin, smooth, light brown tissue strand. This was the remains of the completely absorbed implanted cat's aorta. In the second case, transplantation of the goat's carotid into the dog's carotid, the former after 87 days, was found thrombosed and obliterated.

When one examines the transplanted heteroplastic tissue which is functionally useful, it histologically is anything but normal. In Stich's specimens, the transplanted material was completely disintegrated, for in three weeks there was invasion by a rich cellular tissue derived from the vessel of the recipient into the human, cat, or sheep vessel, and in a shorter time the media was represented by rests lying as scattered areas of tissue in the newly formed scar tissue. Together with these changes, thrombus formation in the lumen of the vessel took place. In those parts of the vessel wall which remained free from these changes for a time and which retained their normal endothelial lining, sooner or later the greater portion of the intima became covered with fibrin, soon becoming organized and covered with fresh endothelial cells. Wood, after examining wax preparations under the microscope, found disappearance of the normal construction of the transplant with substitution of the vessel by fibrous tissues.

Material for transplantation was also obtained from the fresh cadaver. This was called by us implantation. Makkas, Dowman and Stich sutured into the circulatory system of animals, vessel segments obtained from animals killed with chloroform, the specimen being removed in from fifteen to ninety minutes after death and placed in physiological salt solution. Out of five attempts, three were successful while two were followed by fatal hemorrhage.

Carrel and Guthrie extirpated portions of vessels from living animals or from animals shortly before death, placed them in Locke's solution in a glass chamber, at from zero to one degree Centigrade, and preserved them for weeks under sterile conditions. Later these segments were grafted into animals (homoplasty) and good results were obtained even with tissues preserved for 35 days. Microscopic examination revealed extensive changes in the vessel walls.

Bode and Fabian preserved portions of vessels in Ringer's solution at from zero to one degree Centigrade for 60 days and implanted them in dogs, using the vessel suture. In the majority of instances, total thrombus formation occurred, while in the minority the lumina re-

mained patent Bode and Fabian are of the opinion that after preservation of the segments for more than 35 days in the ice box, they become predisposed to injurious changes in the vessel, which they admit cannot be demonstrated microscopically

Carrel performed heteroplastic implantation with segments of dog's carotid and jugular veins, which had been preserved in the ice box as long as three weeks and implanted into the resected aorta The functional healing was apparently successful, although it could not be proved microscopically that the implanted vessel became part of the recipient's tissue Carrel also performed implantation of a portion of the popliteal artery of a man, which had been preserved for 34 days in Locke's solution, into the aorta of a dog Five and one-half months later autopsy *in vivo* demonstrated the implanted human popliteal artery in the same condition as during the implantation, and fourteen months later normal pulse beats were found in both femoral arteries Guthrie also was able to successfully implant into a dog's artery a portion of cat's aorta which had been preserved for four weeks in formalin, and Bode and Fabian report implantation of human vessels into dog's arteries after preservation in the ice box Regarding the changes which take place in veins after transplantation into arteries, Carrel states that first on account of the increased blood-pressure there occurs a hypertrophy of the walls followed later by a disappearance of the muscle bundles with sclerosis of the wall by means of infiltration with fibrous tissues Whether or not there later occurred further changes in the vein is not known, but it is very probable

Vessel transplantation, however, has been utilized for other purposes than for substitution of vessels Eiselsberg reports a case of perineal hypospadias in which he utilized a portion of the saphenous vein as a substitute for the urethra, and almost complete healing was obtained one year after the successful transplantation The sequel of this grafting is a strong tendency to shrinkage of the vein Bakasch substituted in a case of scrotal hypospadias a portion of the basilic vein for the absent urethra with faultless healing, but he fears that this healing will not be permanent Other surgeons also have substituted the saphenous vein for congenital and acquired defects of the urethra sometimes with, and sometimes without, success The gradual disintegration of the vessel segment with subsequent cicatricial narrowing is due to the immediate flow of urine over the endothelium, as proved by Tietze, and Lexer has devised the operation and pleads for the production of a fistula over the implanted vascular tube

Floercken attempted to plant segments of the carotid into the urethra and observed that the endothelium, even when autoplasty is performed, disintegrates, after which suppuration and necrosis of the wall takes place. Here, also, it is true that the immediate flow of urine causes irreparable injury to the endothelium. Vessels which have been utilized to repair gall-duct defects disintegrate probably because of contact with bile.

Ritter recommends in the repair of injuries of the tendons, where tendon suture is possible, but where the union is uncertain, the use of vascular tubes as shields into which the ends of the tendons lie.

Segments of vessels have been utilized with good results, especially autoplastic transplantation of the saphenous vein, as a bridge in the repair of nerves. Some surgeons have seen good results with homoplastic vessel transplantation for this purpose.

Heart—Carrel and Guthrie have performed transplantation of the heart. They transplanted the heart of a small dog to the neck of a larger one and united the divided ends of the jugular vein and the carotid artery with the aorta and the pulmonary artery and the vena cava to the pulmonary vein. The transplanted heart after a short time again began to beat vigorously. At first the auricles, finally also the ventricles, began to beat at the rate of 88 to the minute, while the heart of the recipient beat 100 to the minute. Two hours later thrombosis set in so that the observation terminated.

The above authors also extirpated the heart with the aorta and vena cava and both lungs of a kitten one week old and planted them on the neck of a large adult cat. The aorta was united to the peripheral end of the carotid and the vena cava with the peripheral end of the jugular vein. Circulation in the coronary artery was established at once and the auricles began to beat. The lungs became red and in a few minutes visible pulsations of the ventricles set in. Dilatation of the right heart soon occurred because of the occurrence of œdema of the lungs. In two days the animal died of an abscess of the neck.

Thyroid Gland—Shiff concerned himself with thyroid gland transplantation. He transplanted the thyroid of a dog into the peritoneal cavity of another dog. Some time after the transplantation the animals were killed and it was found that the transplanted glands either entirely disappeared or that only pale red vascular spots were visible at the site of transplantation. Histological examination of these vascularized areas was not undertaken. Thus homoplastic transplantation yielded negative results. Eiselsberg obtained successful results in experiments upon cats. He performed his operation in two steps, removing half of

the thyroid and planting it between the abdominal muscles and the peritoneum. As the second step, a number of weeks later he extirpated the other half of the gland. Tetany did not occur and only appeared when the transplanted and healed thyroid was subsequently removed. In Eiselsberg's researches, autoplasmic transplantation of the thyroid only was considered. However, since in these researches the parathyroids were also transplanted the question remained open, whether or not the thyroid in itself functionated. At any rate, two observations speak in favor of the functional ability of the transplanted thyroid gland. First, as shown by Cristiani, that half of the thyroid when transplanted into the ear becomes larger when the other half is extirpated, and, second, the fact shown by Salzer of the rapid encapsulation and enlargement of the autoplasmic transplanted half of the thyroid when the second half is removed at the same time.

The question as to where the thyroid should be transplanted, in the spleen after Payr, in the peritoneum, or in the bone marrow after Kocher, or in the subcutaneous cellular tissue after Cristiani, is as yet undecided. As a result of experimental investigation which was undertaken by Carraro, of Ribbert's Institute, it appears that the peritoneum or the subcutaneous cellular tissue hold the preference over all other tissues as implantation sites, while the bone marrow, spleen, and liver are entirely too vascular, since the transplanted portion of thyroid at first is always surrounded by a thick layer of fluid blood which forms a more or less thickened ring and later chokes the transplanted piece by means of cicatricial contraction. Bramann believes that this fear of Carraro's can be overcome in making use of the medullary cavity if one takes the precaution to curette out the marrow down to the compact bone and then to fit the transplanted piece so that very little blood can surround it.

The investigations of Stich and Makkas in autoplasmic as well as in homoplasmic transplantation of the thyroid, have been attended with marked advances in this field. Instead of bothering with circular sutures of a very small artery, they resected a rhomboid flap of the carotid and inserted it in the respective hole of the other carotid. Also the difficulties of vein implantation, which were greater than arterial implantation, were also fortunately overcome. Of the homoplasmic transplantations, none was successful, while two out of three autoplasmic transplantations were attended with success. One dog lived 31 days and the other 345 days after operation, they were lively and differed in no way, especially in intelligence, from normal dogs. The anatomically healed thyroid performed normal functions and proof of this was

shown when, after 245 days, extirpation of the healed thyroid was performed, after which the dog became ill and three weeks later he died of cachexia. Thyroid transplantation from man to man has yielded no results. The normal upper pole of the thyroid was transplanted in three cretins by suturing the superior thyroid, artery and vein to the axillary vessels. The grafts healed and after several weeks could be easily palpated, but later became gradually absorbed. The transplantation had no influence upon the intelligence or the growth of the animals.

Attempts at heteroplastic transplantation of the thyroid so far have been fruitless, as have been attempts to replant animal thyroids into man extra- or intraperitoneally, and when Kocher obtained improvements in a case of cachexia strumipriva after heteroplastic transplantation, it can be attributed to the subsequent absorption of the thyroid glands. (Beneficial effects being due to absorption of the thyroid secretion—Translator's note.)

Parathyroids—The first who transplanted the parathyroid was Waldbaum. He transplanted the external parathyroids autoplastically on to the peritoneum of the stomach and at the same time or at another sitting extirpated the internal parathyroids. He established, as a result of this experiment, that the external parathyroids could not maintain their function alone without aid from the internal ones, since the animals came to a cachectic end.

Kamus in 1905 transplanted by homoplasty the parathyroids from the rabbit into the ears of animals from whom he removed the parathyroids, as well as into animals who had not been so treated. The glands which had first healed finally completely disappeared. Cristiani, laying the cause of Kamus' failure to the fact that the ear of the rabbit was a poor bed for the implanted tissue, was able to microscopically demonstrate after autoplasmic transplantation the parathyroids in the ears of cats five years later, and in rats two years later. In 1907 Biedel reported the successful autoplasmic and homoplastic transplantation of parathyroids into the spleen of dogs and cats. In the same year Pool reported heteroplastic transplantation of parathyroids in which the rabbit was the donor and the dog the recipient. The external parathyroids of the rabbit were transplanted into the spleen of the dogs and the parathyroids of the latter removed. All the dogs developed tetany. Pool, therefore, discarded the heteroplastic transplantation of parathyroid and believes that even with a successful homoplastic transplantation one is not certain that the homoplastically transplanted parathyroids, even if they heal, are functionally valuable. Iselin is of the

same opinion, as the result of experiments with which parathyroids were transplanted into tetanic rats after parathyroid extirpation. Leischner reports successful autoplasmic transplantation of parathyroids, and he also obtained healing in homoplasmic transplantation, but in the latter instance, working with Kohler, he admits that the homotransplanted material is of little use, as the foreign tissue, after a short time, is absorbed. Shortly after Leischner's first work there appeared the conclusions of Minkiewitsch that all transplanted thyroids, whether by autoplasty or homoplasty, finally disintegrate even if they functionate for a short time, a fact which is not certain.

Pfeiffer and Mayer obtained a good functional result after autoplasmic transplantation and healing of parathyroids. Hermann and Harvey confirmed these results with homoplasty, although success is not always certain. Melinkow reported like results and was able to prevent the development of cachexia. Landois performed transplantation of parathyroids in the dog, autoplasmically and homoplasmically by artificial emboli in the lumen of the external jugular vein, thus supplying nutrition to the tissue from the circulating blood, and at the same time providing a drain for the secretion of the transplanted organ. It was possible to cause healing with good function of the autoplasmically transplanted parathyroids but the majority of the dogs died after a few weeks of inanition and hemorrhage without tetanic symptoms. Homoplastic transplantation of the parathyroids yielded bad results, the animals failing after operation or dying of tetany. Landois therefore concludes that homoplasmic transplantation of parathyroids in man for therapeutic purposes is without hope.

Adrenals—In 1887 Cannalis attempted implantation of small portions of the adrenal glands, without success, as the implanted pieces became necrotic and were absorbed. De Dominicis found in adrenals planted into dog's kidneys, no change after 10 to 15 days, and Pool in his work on rats noted that the medullary portion disintegrated, while the cortex regenerated. This fact was confirmed by Cristian¹, and Stilling found in adrenals transplanted into the scrotum of rabbits that it contained typical cortical substance after three years. Monsen and LePlay transplanted the left adrenal into the spleen and after several weeks removed the right adrenal. Rabbits survived for three days, young dogs seven days. While the medulla disappeared rapidly, the cortex survived for a long time. Shiota transplanted the adrenal into the spleen and kidney. The animals survived. The transplanted adrenal loses its adrenalin content in 48 hours quicker in the spleen than in the kidneys. After 24 hours, there was no sign of medulla, while cortex

could be demonstrated 10 to 17 weeks later. The survival of the animals after later extirpation of the second adrenal proved the functional ability of the transplanted adrenal.

The adrenal transplantations of Habraro and Storck were successful. In one-half of their cases there was functional as well as anatomical permanent success. The failures can be accounted for by the insufficient nutrition of the transplanted organs. The microscopical examination of the transplanted and healed adrenal showed that in no case did the organ retain its original structure, but it underwent regressive and necrotic, as well as hypertrophic, changes. In the first few days after the transplantation there occurred regressive metamorphosis of the adrenal so severely that only those portions remained alive which were in contact with the vessels. At this site, there begins in the first few weeks after the operation, a vigorous parenchymatous activity which encroaches upon the degenerated portion of the organ. The hypertrophic tissue may later again regress or even become necrotic. The newly formed cell masses may take on the normal form of the adrenal, but there may be some irregularity not only in the cortex, but also in the ramifications of the medulla. In successful transplantation not only is the cortex preserved, which fact has been the basis of all investigations so far, but the medullary substance also remains alive and is able to regenerate and hypertrophy as well as the cortex. Permanent results five months after transplantation have been obtained, and in most cases a new adrenal was built up in which cortical and medullary substance replaced the regressive and necrotic tissue.

The functional proof of successful adrenal transplantation gave the following results. The unilateral transplantation was borne by all the animals (dogs, rabbits and cats) without ill effect. But one cannot say anything positive about the functions of the transplanted organ, since there is a possibility that this function was performed by the remaining adrenal. In a second series, both adrenals were transplanted into the kidney in two sittings with a considerable interval elapsing between the operations. If the second adrenal is transplanted, while the first is as yet in its atrophic and necrotic stage, no hypertrophy takes place and the animals die of adrenal insufficiency. The functional ability of a transplanted adrenal was proved by extirpating the second adrenal some time after the transplantation. In some cases in which there occurred necrosis of the transplanted adrenal the animals survived the second operation for a very short time only. In 9 cases, however, the animals survived the extirpation of the adrenal for a number of days and months. Microscopic examination here showed healing

accompanied by regeneration of the adrenal tissue with destruction of the vessels and revascularization from the kidney. Since there were no accessory adrenals in any of these animals, it follows that the transplanted tissue functionated. It was found here, as in bilateral transplantation, that the animals have a better chance for survival if there is an interval of from 11 to 16 days between the transplantation and extirpation, while a longer interval predisposes to failure. One gains the impression that the intact adrenal has so completely undertaken the function of the injured second organ that it hampers the latter's powers of regeneration. If the other adrenal is injured or removed, during the period when regeneration is at its height, a stimulus is given to the regenerating tissue. In a further series bilateral transplantation of both adrenals was done in two sittings and at a third sitting one kidney with its inlaid adrenal was removed. Out of 11 cases, 6 died of adrenal insufficiency. In all these animals the healed hypertrophic adrenal was accidentally extirpated, while the second on section showed regressive changes. Five dogs survived the operation for a year and a day without symptoms. The extirpated transplanted adrenal here also was hypertrophic. Incidental to homoplastic transplantation of the adrenal in man, von Haberer believes as a result of experiments on the cadaver, in the possibility of implanting into the aorta or femoral vein, the adrenals of dead new-born with its vessel and a piece of the aorta. Lately, Busch and Wright reported regarding heteroplastic adrenal transplantation. They transplanted into a 35-year-old man suffering from Addison's disease, the freshly obtained adrenal of a young pig. The organ was freed from both poles and about two-thirds of the freshened flap was implanted into the scrotum (local anæsthesia) after opening of the tunica albuginea and removal of a like piece of scrotal tissue, the tunica then being resutured. The operation was borne without disturbance, the subjective symptoms improved, the appetite increased, the vessel tone was better and the skin pigmentation was lessened. About two weeks after the operation asthenia set in, the blood-pressure fell, and a day later coma, followed by death. Microscopically, the transplant was found to be adherent to the scrotal tissue, and was separated from the adrenal tissue only by new formed fibres arising from the latter. The cortical substance was rich in blood-vessels and stained well, the medulla in greater part was necrotic and only a few cells could be made out.

Hypophysis—Transplantation of the hypophysis was first performed by Cushing. He was able to prove that the life of an animal in whom the hypophysis was totally removed could be prolonged after

autotransplantation Crowe, Cushing and Homans report that in 23 transplantation experiments on hypophysectomized dogs, in only 7 cases was the extirpation fatal, while in the remaining 16 cases smaller or larger fragments of the anterior lobe were removed. The transplants were placed in the abdominal muscles, in the bone marrow and occasionally with good results in the subcortical portion of the brain. Out of three cases of the last type, one animal died after 48 hours and the transplanted tissue was found to be completely necrotic. A second adult dog showed no disturbance except glycosuria and was killed on the 18th day. In the transplant there was found a normal peripheral zone, containing well stained anterior lobe cells, the central portion was necrotic and in the surrounding brain tissue were many colloid bodies. In the third case there were mild symptoms of cachexia, and on the second day the animal was in normal condition. This animal was killed on the fifteenth day and the findings were like those in the second case. Crowe, Cushing and Homans conclude from their investigations that transplantation of the hypophysis, after complete hypophysectomy, prolongs the life of the experimental animal. Homotransplantation, one or two days after hypophysectomy, yields better results than transplantation before removal of the hypophysis. Attempts to prove functioning of the transplant by subsequent removal yielded negative results in two cases.

Transplantation after partial hypophysectomy prevented in many cases the development of cachexia. In a young dog, after partial and coincident transplantation of the hypophysis into the rectus muscle, mild symptoms developed, which soon disappeared, and a month later they reappeared in increased severity and after homotransplantation, promptly disappeared. Transplantation investigations were undertaken by Bayer, Biedel, Clairmont and Ehrlich for the purpose of establishing hyperpituitarism without result. Transplanted hypophysis can heal in the spleen and intact cells can be found 10 to 14 days later, which finally become necrotic. Shaeffer's work on dogs, cats, apes and rats, transplanting the hypophysis into the brain substance, the subcutaneous tissue, muscle, peritoneal cavity and kidney, was not crowned with any permanent success. There only appeared a temporary increase in urinary secretion. Changes in development and nutrition were not observed. Very interesting was the investigation of A. Exner, who transplanted 7 to 10 hypophyses of like animals into the retroperitoneal space of young rats, using the weaker mates as controls. In 9 out of 11 cases the experimental animal gained in weight over the controlled animals in from 13 to 30 days. The increase in weight was due partly

through an increase in fat and partly through increase in size of bones. On section it was shown that the transplanted hypophyses were absorbed, in only a few cases could the transplanted hypophysis be demonstrated as necrotic cell masses. Whether or not the increase in weight was due to functioning of the transplanted hypophysis or the absorption of its active substance from the disintegrating tissues, was not decided.

Ovaries—In 1895, Knauer reported regarding autoplasmic transplantation of the ovaries. This was performed on rabbits, the ovary being removed from its normal site and transplanted into the mesometrium of the cornu of the uterus, or between the abdominal fascia and musculature. Where successful healing took place, there was no atrophy of the uterus as is usually noted following castration. These observations were confirmed by a number of investigators. The transplanted ovary retained its normal morphological structure, showing well preserved epithelial cells and follicles with unchanged or only a partially degenerated ovarian and well staining interstitial tissue. No difference was noted whether the transplant was pedunculated or not. The permanency of function and preservation of structure of the transplanted ovaries is not lasting, since after a number of months regressive metamorphosis is noted. Kawasoye found after extirpation of both tubes and ovaries with transplantation of half of one ovary into the broad ligament, that 90 days later there was atrophy and destruction of the follicles, degeneration of the ovum and necrosis of the stroma, while after removal of one ovary and transplantation of half into the remaining tube the degeneration was not so intense. Fogus found, after planting ovary into the spleen, that nine months later there was pigmented cicatricial tissue at the site of transplantation.

In homoplastic transplantation, Knauer and Carmichael were not always successful. The transplant rapidly degenerated completely in the researches of Marchese, Herlitzka, and others, while Vish, Foa, McCone, Basso, Lukaschewitsch, Magnus and Guthrie report successful homotransplantation, with not only preservation of the morphological transplanted ovary, but also later regular and normal ovulation, conception and pregnancy. The possibility of conception was proved conclusively by the researches of Guthrie, who exchanged the tubes of pure white and black hens. When the ovary of a white hen was planted into a black one, and this hen was impregnated by a white male, the offspring were white, black and spotted. The conclusions which Guthrie drew from this experiment have been disputed by Davenport and others, but the fact that the offspring were of the color

of the donor of the tube, is positive proof that the birth of these eggs was from the implanted foreign tube. Foa worked out transplantation of embryonal ovaries and was able to prove that they reproduced in a normal manner. In autoplasmic transplantation, it makes no difference where the ovary is transplanted. Halban found in transplantation under the skin, good development of the uterus and genitals, and the transplant did not degenerate. Marschall and Joli, who transplanted ovaries intraperitoneally or into the kidneys, found no sign of degeneration of the uterus, the transplant in the castrated animals healing well, it apparently making no difference whether the epithelium was preserved, or, as happened in most cases, it became absorbed, the follicles disappearing and the implanted organ only remaining as an interstitial remnant.

In most cases of heteroplasmic transplantation, there was no success, although there are some successful reports. Bucura obtained the best results. He transplanted the tubes of guinea pigs into castrated rabbits and found that not only did they heal, but they were capable of function, in that the follicles matured and prevented post-castration atrophy of uterus. Schultz obtained good results in transplantation of the tubes in different varieties of the same species, as with transplantation of the tubes from common guinea pigs into rosette guinea pigs and *vice versa*, between silver rabbits and land rabbits and *vice versa*. The results were apparently permanent, since the epithelium, the follicles and the ova retained their normal structure six months later. Ovary transplantation to foreign species, from the cat to the mouse, from the Japanese dancing mouse to the white mouse, from the dog to the rabbit, from the guinea pig to the rabbit, from the cat to the rabbit, from the mouse to the cat, from the rabbit to the dog, from the white mouse to the Japanese dancing mouse, healed well, and after 14 days was still well preserved but then began to show signs of disintegration.

Transplantation of the ovaries in the human female probably was carried out for the first time by Morris in 1895, in a woman of twenty, with an infantile uterus and amenorrhœa, good healing took place and menstruation followed two days after ovary transplantation. Transplantation and reimplantation of ovaries in women, especially after oophorectomy, has been many times performed for the prevention of post-operative disturbances. The castration atrophy was prevented and almost regular menstruation occurred. Halliday, Croom, and Morris saw, after ovary transplantation, pregnancy and birth of a normal child.

In a 32-year-old woman, in whom 5 years previously one tube was

extirpated, while removing the second ovary for a tubo-ovarian cyst, Kayser planted two portions of microscopically unchanged portions of this ovary into the right thigh through an incision so that it lay beneath the vastus externus muscle, fixing it with catgut sutures and covered it with the fascia lata. Menstruation occurred regularly. It appeared after 23 days, was painless and there were no untoward symptoms. Kayser therefore concludes that it is only necessary to implant small portions of ovary in order to prevent symptoms due to ovarian insufficiency.

Testicles—Testicular transplantation has been carried out for a long time. As early as in 1849 Berchtold successfully transplanted testicles of roosters with good functional results. Regarding the preservation of transplanted testicles, Mantegazza and Bizzozzero, Herlitzka and Zalchas, with frogs, Lode with roosters and Ribberta with nursing animals, showed that the transplanted testicles for a time generate spermatozoa but later undergo a regressive metamorphosis and after a time completely degenerate. Fogus in his researches found after transplanting testicles into the spleen that they became completely absorbed. Foa obtained like results in performing autoplasmic and homoplasmic transplantations in dogs as well as in new-born animals, even though he used small pieces of testicles as well as entire testicles. Maxikoff and later Cevoloto, after histological studies, came to the conclusion that the epithelial tissue of the seminal canals is very delicate and after implantation, the sperm-generating tissue disintegrates, and that the highly differential cells are replaced by a more simple type of epithelium, so that the canals become obstructed and are lined only by the cells of Sertoli. Anyway Fogus was able to implant small portions of testicles with result that they still contained living spermatozoa after months. Roosters which have been completely castrated and transplanted with functioning testicular tissues, it is true, do not develop all the characteristics of the male, yet they are not typical capon. Whether the absence of these characteristics, as Fogus believes, is due to the scarcity of the transplanted portion of testicle, or to the absence of union between the testicle and the vas deferens, as Nussbaum states, is not yet decided.

Steinach attempted to attain complete development of the epididymis, the prostate and penis in young mammals by means of autoplasmic transplantation of both testicles. The sexual desire and potency of the animals were awakened at the proper time and appeared in normal intensity. The development of the male characteristics, the general carriage which this immature animal showed, imitating the adult, was

due to the influence of the testicles Morphological examination showed that the semen generating portions did not develop but the tissues which manufacture the inner secretion, had developed very markedly

Castle and Philipps in 33 attempts did not succeed in homoplastic transplantation, as the transplanted testicles always became necrotic Pogany united two young rats by parabiosis and transplanted their testicles together with the epididymis The second testicles of both animals were extirpated After 10 to 14 days, the animals were separated, the pedicles of the organs being divided Thus each animal had a testicle from the other As long as the testicle had its pedicle, it retained its structure, but after division of the pedicle, the testicle rapidly broke down and became absorbed Heterosexual transplantation of the genital glands has been attempted many times The sex of the recipient has no influence upon the structural preservation of the transplanted gland In the researches of Herlitzka and Bersca on water-moles, after a few months the testicles remained as fibrous rudiments Ovaries implanted into males rapidly disintegrated W Schultz, after implanting ovaries into male guinea pigs, found that they develop and, even after four months, contained well preserved epithelium and follicles, and Busura found in castrated female rabbits in which testicles had been implanted, after 58 days, well preserved seminal canals, containing spermatozoa In order to determine the effect of the inner secretions of the heterosexually transplanted genital glands, Fogus obtained positive results in young hens, in that one year after testicular transplantation, they developed the characteristic head and beard growth of the male, while they retained the spurs and feathers of the female In one case after autopsy, no sign of the transplanted testicle could be found, while in the second case, there was demonstrated at the site of transplantation, a fibrous tumor, rich in blood-vessels Both hens laid eggs and Fogus himself believes that there was no proof of any influence of a heterosexual gland upon the secondary sexual characteristics

Steinach castrated young male guinea pigs and rats and implanted them at the same time with ovaries from the females of the same animals He found that the ovaries transplanted peritoneally or on the inner surface of the abdominal muscles, subcutaneously, healed, developed and functionated in the male organism The follicles developed into larger follicles with normal ova and in part arrived at full maturity, burst and became in part corpora lutea The interstitial cells of the stroma also showed a tendency to reproduction The transplanted ovary

was undersized and did not attain the size of the fully developed ovary in the normal female

The implanted ovary had apparently no influence upon the development of the male. The male characteristics, which reach their complete development before or with puberty, as the erectile tissue of the penis, the prostate, and the seminal ducts, remained in their infantile states, as after ordinary castration, and the inhibitory effect of the ovary could be noted upon the development of the penis and the erectile tissue in male rats. The transplanted ovary exerted a stimulating influence upon the tube and uterus which had been transplanted with it.

Particularly noteworthy was the change of the minor sexual characteristic of the male to typical female organs. In those male guinea pigs which had been castrated and into whom had been transplanted ovaries, there was a remarkable development of the breasts and nipples, their shape and size resembling those of normal females. In normal females, the mammæ begin to develop vigorously at about the third month. The pigmented area about the nipple becomes broad and elevated, remaining free from hair, the pregravid completion of the development progressing gradually. In the operated males this process is accelerated and the male rudiments rapidly are transformed into female organs. The glands attain the size of those of adult females about 8 to 10 months old, and in fact, may even outgrow these. The microscopic examination shows that these breasts which have enlarged because of transplantation, are very similar to the ripe adult female breasts.

The influence of the transplanted ovaries extends over the development, the size and the form of the body and skeleton of rats and guinea pigs. The tendency to rapid, vigorous male growth, after transplantation, is lost in a short time and a transformation toward the gradual weak female development appears. The animals with the transplanted ovaries after a time take on the size and form of females. Growth of hair and fatty deposits bring out the female characteristics, and even psychic changes can be recognized.

Kidney—The first successful kidney transplantation was demonstrated in 1902, although before this time Lubarsch and Alessenry were able to transplant small pieces of kidney tissue into the spleen and lymph-nodes, in order to demonstrate what changes occur in the kidney tubules. I first automatically transplanted the kidney in a neighboring site in a pig with failure because of the difficulties due to the anatomy of the veins in this animal. The first transplantation on the dog failed, because the dogs scratched themselves in the location of the transplanted

kidneys or because of infection due to licking of the wounds. Only when the kidneys were transplanted into the necks of the dogs were the investigations fruitful. Following the suggestion of Payr, I was able to unite the renal artery with the carotid and the renal vein with the jugular vein. I sutured the ureter into the skin wound. Urinary flow from the ureter was at once established, although in the first dog, the ureter after 5 days became swollen and retracted to such an extent that it became invisible and the urine flowed directly from the wound. Further researches taught me that the kidney itself could be made to preserve its function up to 18 days. Autopsy *in vivo* demonstrated distinct changes in the transplanted kidney which was so densely adherent to the surrounding tissues, that when the capsule was freed, hemorrhage occurred from numerous newly formed blood-vessels.

A. Exner attempted similar transplantation without satisfactory results, as in the old Vienna Physiological Institute strict asepsis could not be observed, in spite of this he was able to note urinary flow from a ureter two days later. Stich, Makkas and Bowman transplanted the kidneys into the necks of a series of dogs. Ten days later the animals died of pyelonephritis. For this reason they implanted, in a second series, the vessels of the kidney into the iliac, and the ureter into the bladder. The other kidney was not removed. On the first day after operation, the urine was somewhat bloody but later became clear. Three weeks later the animal died of infection. Autopsy disclosed numerous abscesses in the region about the transplanted kidney, the latter being macroscopically normal and microscopically showing a well preserved epithelium with no evidence of parenchymatous or interstitial nephritis. Very important were the researches which Zaaier carried out in 1908. He transplanted the left kidney of a dog into the groin, uniting the vessels with the external iliac artery and vein, and sutured the ureter into the bladder. Eighty-three days later he removed the right kidney. The transplanted kidney functionated, proving the functional value of kidneys transplanted by autoplasty.

Later Carrel extirpated both kidneys in dogs and replanted one into the kidney region. Out of 6 dogs, 5 survived the procedure, one was killed 21 days after operation, 2 developed secondary contraction of the ureteral anastomosis, dying respectively 17 and 31 days after operation, the fourth animal died two months later because of pyelitis. One dog developed minor complications and 8½ months later was in the best of health. That the implanted kidneys carried out their functions was proven by the good condition of the animals until complications developed. Borst and Enderlen performed transplantations of six kid-

neys, joining the renal vessels to those of the spleen, three of the animals being observed for 34, 56 and 118 days. The kidneys were found in faultless condition, macroscopically and microscopically, functionated well, and one animal, in which the second kidney was removed 18 days later, lived in good condition another 100 days.

The first homoplastic kidney transplantation was performed by myself. I was able to prove three months after my first demonstration that I was successful in transplanting the kidney of one dog into the neck of another, the transplanted kidney after a few days secreting normal urine and completely healing in its new location.

In order to test the functional value of homoplastic transplantation of the kidneys, Carrel and Guthrie at first, later Carrel alone, undertook experiments with various methods. They removed the blood-vessels with the immediate portion of the aorta and vena cava and sutured the flaps into respective openings into the analogous vessels of the recipient. Following this method, the operated animals lived for a longer period of time, there occurred in every instance changes in the site and length of blood-vessels which finally led to chronic stasis, and after a number of weeks, to severe disease of the kidneys. Yet, in one cat, three months after operation the transplanted kidney was demonstrated with normal coloring and shape, and the animal enjoyed good health. Finally, the kidney became smaller, and Guthrie one year later found that it was shrunk and incapable of function. Further attempts were designated as transplantation *en masse* by Carrel and Guthrie. This consists of removing from one animal both kidneys with their blood-vessels, the corresponding segments of aorta and vena cava, together with the nerves and ganglia, the ureters, and a part of the bladder, and implanting them into the abdominal cavity of a second animal, in whom both kidneys had been previously removed. An oblique incision had been made into the aorta and vena cava, and the vessel segments of the first animal were sutured into the ends of the aorta and vena cava, and the bladder segments into the bladder of the experimental animal. The successes of Carrel were extraordinary. Twenty days after this operation the cat was in remarkably good health, its urine was normal. She suddenly died 31 days after operation. Microscopical examination demonstrated an acute interstitial nephritis as the cause of death. A second cat, which remained well for 18 days, died 36 days later of a severe arteriosclerosis which Carrel believes was due to the influence of the new kidney. The first heteroplastic transplantation of the kidney was performed by myself, transplanting the kidney of a dog into the neck of a goat. I demonstrated this goat to the Society for

Physicians in 1903, and the 100 present were able to see a distinct flow of urine from the sutured ureter, thus disproving the statement of Villard that this flow was due to œdema. There was no evidence of œdema. On the next day, when I examined the flow of urine, it had ceased because of thrombosis of the blood-vessels. Carrel transplanted the kidney of a rabbit into a cat. After a period of weeks, the rabbit's kidney was completely absorbed. He also transplanted the kidney of a pig into a dog. Fifteen days later the animal died of infection of the kidney, the size of the latter being about normal.

As early as 1902 I transplanted the kidney of a pig into a woman suffering with uræmia in the severe form. The transplantation was attempted in the left elbow region, but I could not surmount the technical difficulties and, also, the animal died from the anæsthetic. Five years later, Jaboulay attempted heteroplastic transplantation in two incurable nephritics, utilizing the elbow-joint as the site for a goat kidney in one case, and a pig's kidney in a second case, anastomosing the brachial artery and the cephalic vein with the renal artery and renal vein respectively, three days later the kidneys became gangrenous and had to be removed. Into a 21 year old girl, suffering with severe hemorrhagic nephritis, Unger attempted to transplant a kidney of a ten year old ape (*Macacus Nenestrinus*), 32 days after the operation the patient died of œdema of the lungs. Circulation was maintained in the ape's kidney, it apparently was alive 32 hours after the operation, but the question could not be decided whether it functionated or not, since it was not clearly established whether the fluid in the ureters was urine or œdematous fluid. Portions of the kidneys were unchanged, while other portions showed acute inflammatory changes in the renal tubules.

Spleen—Luttke transplanted by homoplasty the spleen of rabbits into the peritoneal cavity, and by heteroplasty into the dog, as well as into a pocket of the spleen itself. The transplanted splenic tissue was demonstrated only for four weeks, after two or three months it completely disappeared. The question as to whether or not the transplanted spleen functionated, was studied by examination of the blood. In the first two weeks the hæmoglobin and the erythrocyte contents diminished, while the lymphocytes increased fourfold. The eosinophilic cells after two or three weeks increased in number. Luttke interprets the increase in lymphocytes as indicative of the functioning power of the transplanted spleen. The functional ability is also proved by the recognition of specific antibodies. In six out of ten cases in which Luttke transplanted the spleens of rabbits which had been immunized

against typhoid fever, by heteroplasty, into dogs and apes, he was able to demonstrate the presence of typhoid agglutinins. Passive immunity was not conferred simply by transfer, but was the result of an active production of agglutinins by the transplanted splenic tissue. This was proved by the fact that the serum of dogs and apes which had been immunized against typhoid fever by the transplanted rabbit's spleen, contained a great agglutinin content, and retained it for three months, while control animals which had been immunized by the injection of splenic extract from immunized animals, contained less agglutinins, which disappeared in from three to six weeks. Carrel reimplanted a spleen which had been washed in Locke's solution, followed by healing without reaction. Since this operation is relatively simple, Stich believes that the possibility of homoplastic transplantation of the spleen is more likely to be successful than that of thyroid and kidney.

Pancreas—Autoplastic pancreas transplantation was attempted by Coffey on dogs. Minkowsky successfully transplanted a portion of the pancreas with a vascular pedicle, the latter being later divided. The transplanted segment healed, and it was shown that it was able to prevent the onset of diabetes. Since then Heron was able to transplant pancreatic tissue into the spleen of pancreatized dogs, in the attempt to improve diabetic symptoms and to prolong the lives of the animals.

Intestine—The idea of enteroplasty occurred to Nicoladoni, who made the suggestion that the construction of an artificial anus after complete resection of the descending colon could be obviated if the removed portion of large intestine could be substituted by a portion of neighboring small intestine which had been lengthened by means of an incision into the mesentery. The borrowed intestine was inserted into the defect of the large intestine and the mobile ends of the small intestine were sutured together. This method was useful in resection of the stomach between the pylorus and cardia, provided that the mesocolon could bear a double incision in order to free the enclosed transverse colon from the gastrocolic omentum. A second method of operation carried out by Nicoladoni was the following. The neighboring small intestine with its mesentery was incised obliquely. The divided ends of the large intestine were united with this incision in such a fashion that the continuity of the intestine was established so that the contents progressed through a portion of the intestinal tract by means of retrograde peristalsis. The success of this second method naturally depends upon the possibility to permanently reverse the peristalsis of a large portion of the intestine, as the contents must, after they pass the first suture line, proceed through the large intestine against the valve of Bauhin, until they find their way

through the reversed, inserted portion of the small intestine, finally being emptied into the rectal extremity of the gut. Digestion must also be reversed. Intestinal digestion must also take place in the transverse colon and fecal bodies must pass through the small intestine shortly before their exit from the body. The principles upon which both operations were founded are very original. The first type of operation will make it possible to insert a substitute for the stomach in resection of that organ, in that the transverse colon, after it has been divided from the descending colon, is implanted in the place of a stomach with its divided mesocolon, the portion of pylorus lying to the left of the operator being sutured into the end of the colon, also lying to the left of the operator, the cardia being sutured on the right side into the other colonic extremity. The success of the operation depends upon the fact that the implanted colon is nourished from the blood-vessels of the divided mesocolon, and, second, that there occurs no disturbance after union of the colon with the stomach, which would be due to a difference in the reaction of the stomach—stomach contents being acid, colonic, alkaline.

I have succeeded in transplanting portions of the intestinal tract in pigs, planting large intestine into the stomach, the stomach into the large intestine, small intestine into the stomach, the stomach into the small intestine, small intestine into large intestine and large intestine into small intestine, the experiments were done on young animals, nursed by their mothers. Three out of eighteen of the animals died, the survivors bore the operations well, they showed no disturbance in digestion, being fed on milk one day after operation, after six days on farinaceous food, and after ten days resumed their normal diet.

Transplantation of the Large Intestine to the Stomach—The cæcum has been transplanted into the stomach in the following fashion. The blind end of the cæcum was removed and by means of a transverse incision was transplanted into the anterior wall of the stomach so that it formed a little pouch. Silk was used here as well as in the following cases. The sutures were in double rows, the deep layer being sero-muscular and the superficial ones serous. The animal survived the operation well and 100 days later was killed. On opening the abdomen, there were present a few adhesions of the stomach to the omentum. The sutured head of the cæcum was completely adherent to the stomach, the peritoneum was even and smooth. The lumen of the caput was not contracted. The differentiation between the inner surface of the stomach from the wall of the cæcum was macroscopically visible, the difference being noticeable, not only in the color, but also in the arrange-

ment of the mucous membrane, that of the stomach being thicker and more massive than that of the implanted segment

The gastric mucous membrane in the immediate neighborhood of the implanted portion was more wrinkled than that further away, which was smoother. The junction between the stomach and the cæcum in some places only was marked by a light, superficial swelling.

Three portions of this tissue were utilized for microscopic examination, first, the swelling, second, the portion of the cæcum, third, the border without swelling. The swelling was confined to the large intestine. The enlargement was due to hypertrophy of the lymph follicles of the implanted intestines, no other changes in the mucosa being observed. The muscularis in the middle of the implanted portion, as well as in a swollen and normal portion, is thickened, this being probably due to ring formation. The stroma is no more vascular than that of the normal intestine, while the submucosa is distinctly richer in vessels than the normal, as well as thicker and richer in connective tissue. Of interest is the fact that the number of ganglion cells in the submucosa is unchanged, the intestinal plexus is apparently intact. It was noted regarding the finer structures of mucosa that the superficial epithelium which covers the spaces between the gland mouths is unchanged, and that they are covered by columnar cells as in the normal gut. The beaker cells in the depths of the glands are not as numerous. It is noteworthy that the implanted large intestine gave a distinct acid reaction, showing that it came in contact on all sides with the gastric juice.

Transplantation from the Stomach Into the Small Intestine — A portion of the wall of the small intestine opposite the mesenteric attachment was removed from that part of the intestine which could be brought in contact with the stomach without difficulty. The extirpated piece was six centimetres in length and $3\frac{1}{2}$ in width. Into this defect was planted a portion of the gastric wall. The stomach wound was then sutured. The animal, which remained under the influence of the anæsthetic for a long time, bore the operative procedure well, soon began to eat regularly and with a good appetite, digesting its food well. Seventy-seven days after operation it was killed. On macroscopical examination, a distinct difference between the two varieties of mucous membrane could be recognized. The mucous membrane of the stomach was continuous with that of the intestine, it is true, but that of the intestine was thicker and protruded more prominently into the lumen of the gut and its color was a deeper red. It must be admitted that the implanted segment became smaller in size. Examination with a magnifying glass as well as under higher power reveals a reflection of the

gastric mucosa over that of the intestine. The mucous membrane of the stomach is lined by one layer of columnar epithelium as usual.

Transplantation from the Stomach Into the Large Intestine—Implantation of a rectangular piece of stomach into the transverse colon. The animal after the operation was in good shape and gained in weight. On examination 53 days after operation, the transplanted stomach is readily found, and the different varieties of mucous membrane are easily made out. The gastric mucous membrane protrudes somewhat into the lumen of the gut, it is thicker and redder and there are present on its surface definite elevations and depressions. Even with the naked eye one can perceive a swelling at the junction of the mucous membranes, which with the magnifying glass is found to be present in the intestinal wall. This swelling affects only the mucous layer and in the submucosa is present a cellular infiltration, although there is no evidence of abscess formation or disintegration. At the site of the swelling there is a wealth of vascular tissue.

Transplantation from the Small Intestine Into the Stomach—From the anterior wall of the stomach a portion five by three centimetres is excised. A low lying loop of the small intestine is selected and a portion about six centimetres in length is removed, and by means of a generous incision, the mesentery is mobilized. The open lumina of the loop are then resutured and on the wall opposite to the mesenteric attachment a long incision is made. The small intestine is then fitted over the wound in the stomach like a cap. At the same time the continuity of the gut was re-established by means of sutures. The pig was killed 99 days after the operation. At autopsy was found a swelling on the anterior wall of the stomach which was found to be the transplanted intestine. On opening the stomach one finds in this intestinal pocket the same food contents as in the rest of the stomach.

Transplantation of an Unpedunculated Gastric Flap Into the Small Intestine—A rectangular portion of the anterior gastric wall $4\frac{1}{2}$ by 3 cm was excised and sutured in the place of a small piece of small intestine which had been removed. The animal was killed 13 days after. On section the stomach was found to be healed. No adhesions. The gastric mucous membrane was easily differentiated from that of the intestine. Microscopically the section appeared normal.

Insertion of Small Intestine Into the Colon—The grafting is performed in such a manner that the direction of the peristaltic waves was not changed. A portion of small intestine $8\frac{1}{2}$ cm long was implanted into the colon, by my method of intestinal anastomosis. One hundred and ten days after the operation, the animal was killed, it weighed twice

as much as at the time of operation. On section, a difference between the small and large intestine was distinctly visible. Externally there was seen a contraction corresponding to the line of union, although there was no difference in color. The mesenteries were united, somewhat thickened, and folded over one another. The mucous membrane everywhere was normal, at the most, there was a slight thickening at the site of junction.

The conclusions that I derived as to transplantation of the intestine was, that it is easily performed on the pig and that these animals survive the operation for a long time and gain in weight after it. I have been asked by Dr. Exner in what manner the foreign piece of mucous membrane protects itself against digestion by the intestinal juices. Many theories have been advanced to answer this question. From the result of my researches it appears that each portion is able to protect itself against the foreign digestive juices, and that when the two varieties of membrane unite, the one of least resistance undergoes swelling.

Rosenberg resected a loop of intestine in the dogs, opened the gut longitudinally and planted it into the incised urinary bladder or into the bladder, the upper half of which had been removed. The transplanted intestine healed and after 2, 4, and 15 weeks did not contract. The intestinal epithelium disappeared and was replaced by bladder epithelium. Transplantation of the intestine as a substitute for the œsophagus has been performed in a number of cases and the intestine healed in its entire length in the subcutaneous tissue between the sternum and the skin.

Prostate—Scrralach and Parre attempted prostatic transplantation by implanting small or large pieces of the prostate subcutaneously or intraperitoneally. The transplanted tissue changed, in that the glands atrophied and the connective tissue hypertrophied.

The hopes which were entertained 15 years ago regarding tissue and autotransplantation have been partially fulfilled, in heteroplastic transplantation it appears that the obstacle to success lies in anaphylaxis, while in homoplasty inherent biochemical characteristics interfere with healing. On this ground only can be explained the unsuccessful results of these types of transplantation as compared to the more favorable and more permanent results in autotransplantation. In heterotransplantation relatively successful results have been obtained, as it is finally replaced by the bone of the recipient. The cell protoplasm, specific for each organism, varies with the individual

There are as many protoplasms as there are individuals. Thus in homotransplantation the appearance in the body of a foreign protoplasm calls forth ferments into the circulation which destroy the transplanted tissue. The statement of Roux which he made in 1895 that a part of an organism will accustom itself to the surroundings in another organism cannot in this era be accepted. Whether it is possible or not to artificially alter the bloods of two individuals so that homotransplantation will be successful, is questionable. For this purpose, one could resort to parabiosis.

CHRONIC ULCERS OF THE STOMACH AND DUODENUM*

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FIRST PERIOD 1893 TO 1900 PYLORIC OBSTRUCTION—The first case of pyloric obstruction in St Mary's Hospital was operated on in 1893 This operation was a Heinnie-Mikulicz pyloroplasty The second operation was a gastrojejunostomy with the Murphy button. From this time on, a gradually increasing number of such operations were performed in our clinic However, only those cases with marked obstruction at the pyloric end of the stomach were operated on and at the time of the operation the obstruction was believed to be the result of gastric ulcer, although the exact location of the ulcer, whether in the pyloric end of the stomach or in the duodenum, was not determined

SECOND PERIOD 1900 TO 1906 GROWTH OF KNOWLEDGE THE RESULT OF SURGICAL OBSERVATION—During this period it was recognized that obstruction was a terminal condition and a study of the subject was commenced with a view to the earlier termination of a malady, which exposed the patient to serious dangers and more or less constant disability and distress There was much discussion of mucous ulcers, erosions, and a variety of supposed lesions which was not the result of actual observations at the operating table, but of an attempt to furnish a pathologic basis for the symptoms complained of by the patient This atmosphere of uncertainty gradually disappeared and patients were explored for symptomatic indications, but not operated on unless a pathologic basis for those symptoms could be demonstrated at the time of the operation The Murphy button was gradually abandoned for the suture and the anterior method of gastrojejunostomy replaced to as great an extent as possible by the posterior.

THIRD PERIOD. 1906 TO 1914 DEVELOPMENT AND IMPROVEMENT IN DIAGNOSIS—The great value of the history and physical findings in diagnosis was emphasized The relation of the clinical symptoms to the lesion was shown in the light of operative experience and the value of the purely laboratory examinations of gastric contents were found to have been over-estimated The Rontgen ray gradually won

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CHRONIC ULCERS OF STOMACH AND DUODENUM

first place in the diagnosis of these lesions and the necessity for the excision of gastric ulcers, because of the menace of cancer, was recognized

Our Present Status—Up to December 31, 1913, 1841 cases of acute and chronic ulcers of the stomach and duodenum had been operated on in St Mary's Hospital. Of this number, 437 were females and 1384 were males. The early clinical view of a preponderance of females over males was thus shown to be in error. It is probable that a large number of these supposed ulcers in women were in reality the result of pyloric spasm due to cholelithiasis or some intestinal lesion which gave rise to the gastric disturbance.

In 636 of the 1841 cases, the ulcers were located in the stomach and, in 1205 they were located in the duodenum. It must be borne in mind that all of the early cases were supposed to be gastric and so classified. The percentage in the last 1000 accurately observed cases showed 73.8 per cent duodenal and 25.2 per cent gastric. Of the gastric, 29 per cent were females and 71 per cent males. Of the duodenal, 21 per cent were females and 79 per cent males.

In differentiating between an ulcer in the pyloric end of the stomach and one in the first portion of the duodenum, the situation of the pyloric veins is the determining factor. Just at the pylorus, from above and below, short, thick veins, usually 1 to 2 cm in length, come into view from behind and pass forward. There is a distinct notch at the points of emergence of the veins. From these veins there usually extends an arching vein from each side, sometimes uniting, forming the pyloric vein, sometimes ending in a spray. This superficial pyloric vein is not so characteristic as the thick veins I have just described, but, when present, it is a ready means of differentiation.

The terminal three-fourths inch of the pyloric end of the stomach is not often involved in ulcer. The more common seat of gastric ulcer is along the lesser curvature, often saddle-shaped. The ulcer is more often on the posterior than the anterior wall. But whether situated anteriorly or posteriorly, a superficial ulcer at the point of contact often appears on the opposite wall, the "contact" ulcer. The gastric ulcer itself is, as a rule, clean cut, with a hard grayish-white base, and is round or oval in shape. Outside of its crater there often is a massive infiltration into the outer layers of the muscularis and peritoneum. Over this, very frequently, protective adhesions are found sometimes binding the seat of the ulcer to other organs, such as the pancreas or liver, a condition of incomplete or protected perforation. The indura-

tion is always very much more extensive than the actual crater and is not entirely dependent on the size of the ulcer. The situation of the ulcer, however, may be at any point in the wall of the stomach.

Multiple ulcers are not frequently found at operation, which is contrary to the early views based on clinical observations and post-mortem findings in deaths due to acute ulcerative processes in the stomach. These processes were usually gastrototoxic in origin and not often the source of chronic ulcer. Multiple ulcers of the stomach and duodenum or separate ulcers of the stomach and duodenum exist in the same case in about 5 per cent of the cases.

The character of ulcers of the duodenum differs in many respects from that of ulcers of the stomach. They are usually to be found in the upper two inches of the duodenum and more often in the anterior-superior wall. When found on the posterior wall, they are usually of the same character as when found in the stomach. A typical crater and the contact ulcer on the anterior wall may give rise to an independent induration. As a rule, the duodenal ulcer has its origin below the pylorus, but when it extends toward the stomach it usually stops short at the pylorus, which it may undermine. In exploring for ulcers of this description I have occasionally had difficulty in discovering the posterior ulcer because it was concealed underneath the projecting pyloric ring. The mucous membrane of the upper duodenum is thin and granular and ulcers confined to the anterior wall, if they take upon themselves the crater-like character of the gastric ulcer, will develop a localized mass over the site of the ulcer. Many times, however, no crater is found in the mucous membrane in duodenal ulcer, but rather a discolored, moth-eaten patch in the centre of which may be a dimple-like ulcer and outside of this a typical induration. It is probable that this variation from the ordinary type of gastric ulcer explains why duodenal ulcers have been so frequently overlooked at autopsy.

There is a variety of duodenal ulcer which sometimes occurs in the region of the papilla of the common duct, giving rise to attacks resembling gall-stone colic and profuse hemorrhages. The three cases I have had an opportunity to examine have all been seen post mortem, the patients dying from acute hemorrhage after prolonged symptoms resembling cholelithiasis.

Incomplete protected perforation of duodenal ulcer, giving rise to localized peritonitis covered by adhesions, is common. The observation of such patients operated on during an attack has shown a localized peritonitis in the vicinity of the ulcer which makes it probable that an

actual leakage had taken place but that the resistance of the peritoneal cavity was sufficient to care for the comparatively small amount of more or less sterile secretion which escaped. Occasionally this localized infection results in a phlegmon, sub-diaphragmatic or otherwise.

Indications for Operation—In the early history of the disease long periods of remission may occur in which it would appear from the symptomless course that the ulcer had healed. Yet case after case operated on during the period of remission does not show the ulcer to be healed—thereby repeating the history of appendicitis and gall-stone disease inasmuch as the recovery from each attack is erroneously supposed to be a cure. Permanent healing of chronic ulcers of the stomach and duodenum by non-operative means must be of rather infrequent occurrence. That a large number of acute, subacute, and some chronic ulcers are cured permanently cannot be doubted, but if they fail to show permanency after a reasonable attempt at cure under ordinary conditions of life, the patients should be treated surgically, not only from the standpoint of the disability of the patient, but also from the standpoint of mortality. The patient with ulcer treated medically is in far greater danger of death from hemorrhage, perforation, obstruction or cancerous degeneration than he is from an operation. Those patients who can afford to carry on prolonged treatment are, of course, in better condition for non-operative therapy than is the working man who must earn his living and live on those things which he can obtain.

THE SURGICAL TREATMENT

Gastric Ulcer—Gastrojejunostomy is the most generally useful operation for gastric ulcer and has a wide field of application. Especially is this true when there is obstruction in the vicinity of the pylorus. It may be said that the greater the obstruction within limits, the more immediate and permanent the results of gastrojejunostomy. It is probable that gastrojejunostomy is of value not only as an operation for drainage, but that it also changes the physiology of the stomach and brings a greater measure of relief than can be achieved without it. While posterior gastrojejunostomy is the operation of choice, in certain cases adhesions may prevent its use. In these cases the anterior operation has given good results. For those ulcers which lie in the body of the stomach and in which the gastrojejunostomy must be made beyond the point of ulceration the results are less favorable.

Because of the menace of cancer all ulcers of the stomach, without regard to their situation, should be excised if possible. In our expe-

rience local excision of the ulcer without gastrojejunostomy has sometimes failed to affect a cure I believe, therefore, that, as a rule, gastrojejunostomy should be done in addition to excision

When a resection in continuity of the stomach with end-to-end union has been made for chronic ulcer, the results have been excellent without gastrojejunostomy

For posterior ulcers of the body of the stomach which have become adherent, especially to the pancreas, transgastric excision of the ulcer has been of service

In *hour-glass* stomachs gastrogastrostomy is a desirable operation, although resection in continuity when it can be done has given good results In some cases, gastrojejunostomy fulfills the indications admirably

When the ulcer occupies the pyloric end of the stomach, the pylorotomy of Rodman gives excellent results, both immediate and remote

In those ulcers of the body of the stomach that cannot be excised and in which gastrojejunostomy cannot be done, temporary jejunostomy is distinctly useful, especially in cases in which a differential diagnosis between malignant and simple ulcer cannot be established The procedure gives prolonged rest to the stomach and maintains good nutrition Jejunal feeding may be maintained for several months with distinct advantage

Ulcer of the Duodenum—Gastrojejunostomy is a most satisfactory operation in all those cases of ulcer of the duodenum in which there is actual or potential obstruction We have followed Moynihan in infolding the ulcer with fine silk and placing one or two sutures in such manner as to block the pylorus to prevent food entering the ulcer-area during the healing period This blockage by suture cannot be expected to be permanent, but in connection with the permanent obstruction produced by healing of the ulcer it usually answers the purpose If there be neither actual nor potential obstruction, this blockage should be accomplished by more efficient means We have used the fascia-closure of Wilms and the omental strip-closure of Kolb, in each case applying the living tissue to the groove previously made by the suture-blockage Several of these patients were re-examined some time after the operation and the pylorus was found blocked

At the present time we are excising a considerable percentage of duodenal ulcers when they are situated so that it may be readily done In our earlier cases simple excision was practised and a certain percentage of them failed to obtain complete relief It was found neces-

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sary to make thorough provision for drainage at the pylorus after excision either by the Heintze-Mikulicz pyloroplasty or, what we have found still better, the gastroduodenostomy of Finney, which lends itself admirably to the excision of the duodenal ulcer.

Results of Operation—Duodenal and gastric ulcers at the pyloric end of the stomach yield equally good results following operation. The greater the distance of the gastric ulcer from the pylorus the greater the technical difficulties in its operative relief, the greater the mortality and, on account of the deformities which may be occasioned, the less certain the cure. But taking the patients as they come, at least 95 per cent of those with gastric ulcer will be cured or greatly relieved by operation. The operative mortality in the gastric ulcers, counting all cases dying in the hospital without regard to length of time thereafter nor cause of death, was 3.8 per cent. This includes acute perforations, acute hemorrhages and all types of operations, resections, etc. The results in duodenal ulcer are extraordinarily good, 98 per cent. of the patients either being cured or greatly relieved by the operation. The mortality of this group was only 1.5 per cent.

Recurrence of Ulcer—In a small percentage of the cases of both gastric and duodenal ulcers there has been a definite recurrence of symptoms and in which it would appear an actual redevelopment of the original ulcer had taken place. A small number of these patients have been reoperated on in our clinic and in each instance the source of trouble proved to be a gastrojejunal ulcer in the suture-line of the original gastrojejunostomy, as a rule due to the sloughing of the continuous sutures of silk or linen which had been used in the gastrojejunostomy. The symptoms were quite like those the patient was suffering from at the time of the primary operation, showing that the same disturbance may come from suture-ulceration as that manifested by the original lesion. We have, therefore, abandoned continuous silk sutures in gastrojejunostomy, now using interrupted musculoperitoneal sutures of fine silk with continuous chromic catgut for the inner rows.

Occasionally, fixation of the pyloric end of the stomach in the adhesions about an ulcer has continued to give rise to such pain and distress as to lead to the belief that the ulcer had recurred or, at least, to the idea that the operation was a failure. In these cases the unilateral pyloric exclusion of von Eiselsberg as a secondary operation has given permanent relief.

BIBLIOGRAPHY

- Finney *Johns Hopkins Hosp Bull*, July, 1912, pp 155-161
Heinicke Inaug Dissert, Furth, 1886
Kolb *Munch med Wochenschr*, October 28, 1913, p 2400
Mayo, W J *ANNALS OF SURGERY*, December, 1910, lii, pp 797-800
Mikulicz *Archiv fur klin Chir*, xxvii, p 79
Moynihan *Trans Amer Surg Assoc*, 1903, xxi, pp 135-207
Rodman *Trans Amer Surg Assoc*, 1902, xx, pp 186-187
Wilms Personal communication, *The Lancet*, November 15, 1913, p 623

ULCER OF THE STOMACH AND OF THE DUODENUM*

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I. RELATIVE FREQUENCY OF GASTRIC AND DUODENAL ULCER

GASTRIC ulcer described by Cruveilhier in 1830, from the point of view of pathological anatomy and the clinic, for a long time alone occupied the attention of physicians and surgeons. These knew well the acute peritonites resulting from perforation of duodenal ulcers, but this was almost the only point which interested them in the history of these ulcers.

In 1887, Bucquoy showed that, besides the perforation, a duodenal ulcer might declare itself by hemorrhages and even by simple dyspeptic troubles. A simple ulcer of the duodenum, he says, causes symptoms which, without having absolute pathognomonic value, have characteristics peculiar enough to permit us to make with a fair degree of certainty a diagnosis of the duodenal lesion. These symptoms are

First, the intestinal hemorrhages, or melæna, occurring suddenly breaking out in the midst of apparently perfect health, and repeating themselves during several days with more or less intensity, so as to compromise seriously the lives of the patients. Often a melæna is accompanied or preceded by some hæmatemesis due to the regurgitation of the blood into the stomach.

Second, pain which, when it exists, which is the usual case, has for its location the zone underlying the lower surface of the liver, a little to the right of the median line, between the costal margin and the iliac crest. One may observe in duodenal ulcer the xiphoid and dorsal points belonging to simple ulcer of the stomach.

Third, digestive troubles, of which those most special to the malady are crises of pain often of extreme degree, accompanied or not by indigestion, which have the characteristic of manifesting themselves usually from three to four hours after the ingestion of food. The

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appetite is usually preserved and the disease develops in a general fashion by crises separated by intervals of good health

Although the clinical recognition of duodenal ulcer may, therefore, be traced as far back as 1887, it is, however, just to recognize that until the labors of the English and American surgeons, especially Moynihan, duodenal ulcer was practically unknown to surgeons. For the last ten years, on the contrary, ulcer of the duodenum has occupied the front rank and our English and American colleagues attribute to it a considerable importance in the genesis of many dyspeptic troubles formerly commonly attributed to gastric ulcer. Indeed, it may be that duodenal ulcer is more frequent than gastric ulcer and its medico-surgical importance may be of the first rank.

Is this preponderance assigned to duodenal ulcer real, or have they not at the present time, on the contrary, given by a sort of seesaw play to duodenal ulcer, formerly not understood, an excessive importance? With the majority of the French surgeons we have thought that there is a manifest exaggeration in the present state of opinion. It is, indeed, true that we have for a long time failed to appreciate duodenal ulcers. Since our attention has been drawn to them by the English and American surgeons, we discover them from time to time, which otherwise we would have allowed to pass by. Notwithstanding this, in our statistical collections the frequency of ulcer of the duodenum remains much less with us than that of gastric ulcer, about one duodenal ulcer to eight or ten gastric ulcers. We are able to explain this difference between our figures and those of our American and English colleagues possibly in two ways: either duodenal ulcer is really more frequent in England and America, than in France, or our English and American colleagues make too readily the diagnosis of ulcer of the duodenum. The first explanation is, perhaps, correct. It is certain that food and mode of life play a very important role in the genesis of gastric and duodenal ulcers. The single fact that duodenal ulcer is relatively more frequent in men and gastric ulcer in women shows that there is something particular in the mechanism of the production of the two different kinds of ulcer. Ewald has noted that in the east of Germany hyperchlorhydria is more frequent than in the other sections of that Empire. It is then possible that duodenal ulcer is really more frequent in England and in the United States.

However that may be, one fact seems established, namely, that in France, at least, ulcer of the duodenum is much less frequent than ulcer of the stomach. Mathieu, making with great care a series of

autopsies with this special point in view, found four duodenal ulcers to 29 gastric ulcers. This figure agrees a little more nearly with that of the statistics, both anatomo-pathological and clinical, of Ewald, who finds 82 duodenal ulcers to 532 gastric ulcers. That is, one duodenal ulcer to from 6 to 7 gastric ulcers. One may, it is true, object that duodenal ulcer is often minute and may reveal itself at necropsy only under the form of an abrasion, or by a very small cicatrix visible among the mucous folds. This is a point upon which Codman insists. But it is the same with ulcers of the stomach and, if the abrasions or minute cicatrices of the duodenum do not figure in the statistics of Mathieu, neither do those of the stomach. We conclude therefore, contrary to current opinion, that according to the revelations of autopsies duodenal ulcer is much less frequent than gastric ulcer.

Do observations made in the course of operations warrant the affirmation as to the much greater frequency of duodenal ulcer? It is upon these principally that the English and American surgeons base their opinions.

Now what do they give as anatomical proofs of the existence of a duodenal ulcer *in vivo*? Often lesions of doubtful interpretation and slight roughness of the serous surface of the duodenum, a grayish plaque of cicatricial appearance. Sometimes even they have seen nothing and yet they affirm a duodenal ulcer. What seems to us the most important of these operative demonstrations is that, in the cases of duodenal ulcer accompanied with dyspeptic troubles for which surgical intervention has been done, the lesions found are always extremely near the pylorus. They are often so near it that to know whether they are above or below it our colleagues Moynihan and Mayo have fixed their exact situation by their relation to an anatomical landmark which they regard as very important, "the pyloric vein." Whatever is on the right of the vein is duodenal, whatever is on its left is pyloric. Now, this landmark is untrustworthy. The systematic researches of Latarjet, of Houdard and Mocquot have shown that the pyloric vein cannot be considered as an infallible guide. By his numerous researches our pupil, Houdard, comes to this conclusion that "nothing in the aspect of the veins of the region can enable one to recognize the seat of the pylorus and that the veins visible upon the anterior face of the pylo-duodenal segment without distinction, such as one sees in the course of an operation, cannot furnish a good surgical landmark at once easily recognizable and constant in its existence and in its location.

We arrive then at this conclusion that the demonstrations made in

the course of operations permit one to affirm only one thing, that is, that the lesions are situated in the immediate neighborhood of the pylorus which may be on the gastric or the duodenal side

Can one make with certainty a preliminary diagnosis of ulcer of the duodenum? Moynihan thinks so and goes so far as to say that the diagnosis of duodenal ulcer can be made by correspondence. A story of late pain, a painful sensation of hunger relieved by the taking of food will suffice, according to his opinion, to determine the diagnosis. In reality, these symptoms far from being characteristic of duodenal ulcer are only one of the elements of the symptom-complex which one of us described in 1899 with Soupault, under the name of pyloric syndrome. They denote the existence of a pyloric spasm, whatever may be the cause of it. Pyloric spasm whether due to a gastric or duodenal ulcer gives these sensations of late pain coming on from three to four hours after meals, often at night, with a painful sensation of hunger relieved by the ingestion of some food. Sometimes this late pain is relieved by vomiting provoked. We have observed patients who, although presenting all the so-called characteristic signs of duodenal ulcer, in reality were the subjects of a gastric ulcer near the pylorus. Such was the case cited by one of us at the French Congress of Surgeons in 1910. The simple resection of a gastric ulcer near the pylorus without gastrostomy cured the patient. One may not suppose here that the symptoms were due to an unperceived duodenal ulcer, since there was no shifting of the alimentary circulation, and the patient was, nevertheless, completely cured. Finally, it is well to remember that these symptoms which are thought to be so characteristic may be wanting in cases of duodenal ulcer clearly established by operation, so that in an important statistical collection obtained from the practice of the surgeons of Edinburgh quite recently, one will find noted that out of 200 cases of perforated duodenal ulcers, in 17 there existed before the perforation no sign suggestive of the existence of such an ulcer (or 10 per cent). In 55 instances of the 200 cases (quite 25 per cent) the pre-existing dyspeptic troubles were very vague and in no case did there exist the symptoms supposedly characteristic of duodenal ulcer. These symptoms given as characteristics of the existence of a duodenal ulcer by the German and American authors are in our opinion purely and simply signs of pyloric spasm.

Bier in a recent memoir protested also against the ideas of Moynihan and based his opinion upon the analysis of 43 cases which he had observed in the course of the last 18 months. Leon Meunier, by a radio-

graphic examination made at the moment of a painful crisis in a patient suffering from an ulcer near the pylorus, demonstrated the reality of the pyloric spasm

This idea of spasmodic contraction with pain and hypersecretion due to an ulcer near the pylorus is of the greatest practical importance, but it would be quite rash to affirm that all the troubles which this spasm produces are clinical symptoms characteristic of duodenal ulcer. Moreover, practically these discussions lose much of their interest since whether the ulcer is seated upon the gastric side or upon the duodenal side of the pyloric valve, the conduct of the surgeon will vary but little, as we shall see further on

II PATHOLOGICAL ANATOMY

1 *Gastric Ulcer*—A recent ulcer of the stomach is rarely met with by the surgeon except in cases of perforation or in grave hemorrhage. Succeeding to an area of hemorrhagic necrosis of the gastric mucous membrane which has undergone at this point autodigestion, this ulceration may be difficult to discover in the living in the course of an operation. Sometimes nothing reveals it, neither to the sight nor to the touch. It is often necessary to incise the wall of the stomach and to examine with care the whole mucosa in order to discover the point of ulceration which is bleeding. These minute ulcerations of the mucosa, which Dieulafoy proposed to call "*exulceratio simplex*," are often very difficult to discover even on the autopsy table with the stomach open and spread out, notwithstanding these simple ulcerations may be the seat of a mortal hemorrhage. It is, justly, this considerable difficulty in discovering a gastric ulceration which so often renders unsatisfactory operations of urgency for grave hemorrhage

The chronic ulcer that we meet much more often in the course of our operations may present itself in several different anatomical aspects

a Simple ulcer with borders moderately thickened reveals itself immediately to the view and to the touch. The serosa on its level presents always alterations due to chronic inflammation. It is œdematous, has lost its polish, is thickened, much congested, and with reddish spots disseminated through it. Its aspect differentiates it from the cancer plaque of the gastric wall seen from the side of the serous membrane. In cancer, the serosa in general is altered, but it has a whitish color, nowhere congested, and one sees often, with the naked eye, on its surface fine whitish lines or a network of yellowish points which correspond to the lesions of subserous cancerous lymphangitis. The neighbor-

ing lymphatic ganglia of the ulcer are sometimes increased in size, but if they are large, they remain relatively soft and movable and do not resemble, as a general rule, the cancerous adenopathy form of ganglia which are small and very hard

Evidently these data furnished by simple macroscopic examination are not entirely free from criticism. They have only a relative value, but they can, nevertheless, permit us to differentiate at once an ulcer from a cancer of the stomach and in this respect they make, from the standpoint of pathological anatomy studied upon the living, a point of great interest to the surgeon

The surgeon often meets, in the course of his work, ulcer partially healed by fibrous cicatrization. We say partially healed because it is always impossible to know by the simple macroscopic examination which one makes at the moment of the operation whether the cicatrization of the ulcer is complete. The contracted pylorus, the stomach made bilocular by an ulcer with a mesogastric location, have an appearance quite special to them which all surgeons are familiar with. Externally the gastric walls present a grayish white color. They are very hard to the touch and often by perigastric adhesions are joined to neighboring organs. It is impossible to know on account of all these lesions of cicatricial sclerosis whether the ulcer is really completely healed or whether it still presents some activity. This remark is important, we believe, for it appears to us to involve condemnation of operations which have the pretense of treating as definitely healed those ulcers which are only partially healed, such as the direct plastic operations, pyloroplasty or gastropasty in which sutures are inserted into tissues incompletely sclerosed and still inflamed, in which cases observation has shown that there is great risk of failure

The callous inveterate ulcer has as its anatomical characteristic a thickening, often very great, of its borders and a fibrous induration of its base. This ulcer has burrowed through the whole thickness of the gastric wall and its base is formed either by the inflamed and sclerosed epiploon, or by a neighboring organ which has been directly invaded, penetrated by the ulcer. One may give, then, the name of "penetrating" to those callous ulcers which penetrate into the pancreas, the liver or abdominal wall. When the ulcer is seated, as it frequently is, upon the small curvature of the stomach, it may remain relatively free and may penetrate only into the lesser omentum which becomes thickened and sclerosed. Upon complete sections of the callous ulcer of the lesser curvature one sees that the old gastric wall is destroyed

and that the base of the ulcer is formed by the sclerosed and thickened omentum. The borders of the ulcer in the gastric wall are very thick and present a very marked inflammation of all the tunics. The muscularis is infiltrated, sclerosed, and the mucosa exhibits often œdematous formations which may be polypoid in appearance.

The microscopical examination of the wall of these callous ulcers shows quite constantly grave alterations of the arteries and veins, endoperivascularitis often obliterating. These vascular lesions, primary or secondary, it is difficult to define, explain the poor nutrition of the tissues forming the base and the borders of the ulcers and the little tendency to heal which is a characteristic of these callous ulcers. We have many times found in the walls of these callous ulcers of the lesser curvature the lesions of neuritis and alterations of the small nervous ganglia situated in the tunics of the sclerosed muscular walls. These alterations upon which Loeper has recently insisted are interesting and may explain the persistent pain which is often a predominating symptom of non-stenosing callous ulcers.

From the operative standpoint, the idea of a callous ulcer penetrating into an organ, such as the pancreas or liver, is important and we shall have to insist upon it again when we shall speak of the treatment of these ulcers. Suffice it to say for the moment that this penetration of the ulcer into a neighboring organ, although it complicates seriously the intervention, is not, however, a sufficient reason for causing excision of these ulcers to be rejected. To the naked eye the diagnosis between a callous ulcer, whether penetrating or not, and a cancer of the stomach wall is always difficult. It is chiefly the œdema and the notable congestion of the neighboring tissues and the absence of, especially, the inflammatory complications of neighboring glands which enables us up to a certain point to differentiate with the naked eye ulcer from cancer. We attach no value on our part to examinations made extemporaneously by frozen sections. This technic which may appear very modern and very elegant is really a snare, for in the doubtful and difficult cases, the only ones important in this class, the rapid examination of a few sections hastily stained can give no certainty. Reliance must then be based upon the macroscopical examination and upon the previous clinical study of the living patient.

2 *Cancer Ulcer*—The transformation of the chronic ulcer into cancer, or, better, the development of cancer upon the borders of an old callous ulcer, gives a question still under study and very differently

answered by authors. Some such as Wilson and MacCarty, examining the specimens furnished by the Mayo clinic, estimate that 71 per cent of the callous ulcers of the stomach present lesions of cancerous development. Others, more reserved, assign only 10 per cent as the average frequency of a cancerous degeneration of gastric ulcers.

Without going so far with certain authors as to deny the existence of ulcero-cancer, which would be too radical, we think, nevertheless, that the development of a cancer upon a chronic ulcer of the stomach is rarer than certain recent authors consider it to be. Hayem and Lion out of 94 gastric cancers studied completely from the point of pathological anatomy have found 21 cases of ulcero-cancer, being about 20 per cent. Upon 14 specimens of resected callous ulcer we have three times found cancerous degeneration in the borders of the ulcer, the base of the ulcer remaining free from the neoplastic invasion, also about one-fifth. In 10 other specimens which could be interpreted macroscopically cancers, because of the deep white central ulceration with elevated and thickened borders, we have found diffuse cancer lesions both at the base of the ulcer as well as upon its borders. We think that it is impossible in these cases to say that they were ulcero-cancer rather than ulcerated cancer. It should be added further that practically the diagnosis of ulcero-cancer should be based quite as much upon the complete clinical history of the patient as upon the simple examination of the pathological specimens.

3 *State of the Gastric Mucosa at a Distance from the Ulcer*—We have often taken away, in the course of gastro-enterostomies done for gastric ulcer near the pylorus, fragments of the gastric mucous membrane. These fragments have always been taken at the same point, that is to say at the level of the most dependent portion of the pyloric antrum, the point where we make the gastro-intestinal opening. Of 30 fragments of mucosa thus taken away we have found 25 times the lesions of gastritis, sometimes hyperplastic parenchymatous gastritis with multiplication of the principal follicles, sometimes mixed gastritis characterized by a small follicular lesion which is due to an interstitial reaction, evidenced by infiltration with embryonic cells, or an abnormal abundance of lymphoid tissue in the mucosa.

Such frequent existence in connection with ulcers of the lesions of gastritis, which have been so well described by Hayem and Lion whose nomenclature we adopt, is interesting to be noted by the surgeon. They show us, in fact, that in the surgical treatment of gastric ulcer one should never forget that one has to do with a gastric mucosa most

frequently altered in its entire extent, whence, as a logical consequence, the importance of post-operative medical treatment which should be continued a long time in ulcer patients who have been operated, if one wishes to obtain permanent success

III CLINICAL STUDY

The clinical signs of ulcer of the stomach and of the duodenum are generally well known. We mention simply the importance of alimentary stasis in the early morning as a sign of stenosis, that of blood, even in small quantity, possibly discoverable only by chemical research, as a sign of ulcers in process of development and we shall insist simply upon the symptoms which sometimes permit us to diagnosticate the seat of these ulcers

1 *Ulcers Near the Pylorus*—Their symptoms are those which have been attributed by Moynihan to ulcers of the duodenum. We have set them forth above and consequently will not return to them now, as we have already said it seems to us impossible by a simple analysis to say whether the ulcer is seated upon the gastric or duodenal side of the pylorus

Meunier has, however, pointed out recently a process which will permit of localization of an ulcer. This is as follows. After having emptied and washed the stomach, one makes a second washing with 200 grammes of 1 per cent solution of glacial acetic acid. When this solution comes in contact with the pylorus, the pylorus closes and the duodenum cannot be bathed by this liquid. The acetic acid solution dissolves the crystals of hæmatin which exist upon the surface of the ulcer however small it may be. One seeks later in the liquid extracted through the tube, blood by the usual chemical process. The reaction is positive, if there is a gastric ulcer present, negative, if the ulcer is seated in the duodenum.

2 *Ulcers of the Lesser Curvature*—Their symptomatology has been carefully studied by Loeper and Schulmann. Pain is an essential element of the syndrome presented by ulcer of the lesser curvature. This pain follows close upon the ingestion of food, it persists sometimes during the entire process of digestion, but becomes lessened generally at the end of an hour. It is a very severe pain presenting suffering which radiates from the epigastric notch to the base of the thorax under the sternum and the ribs of the left side. Palpation of these regions reawakens the pain. Vomiting is frequent, it is often early.

clear, with mucus and threads, suggesting the saliva in its aspect. Nausea which is rare in ordinary ulcer of the stomach, is constant in ulcer of the smaller curvature. This nausea may persist even without respect to meals during several weeks. Early ptyalism coming on half an hour after the meal is often prolonged beyond the pain. This ptyalism provokes spitting or fear of saliva and of air. One observes frequently in patients attacked with ulcer of the lesser curvature circulatory troubles, bradycardia, lessened arterial tension. The oculo-cardiac reflex of Ashner and Miloslavich, that is to say, the slowing of the heart under the influence of the compression of the two eyeballs, may be met with, exaggerated in patients attacked with ulcer of the lesser curvature. This phenomenon may be due to a latent irritation of the pneumogastric nerve, quite explicable in those patients whose ulcer irritates the inflamed nervous filaments of the gastric wall. We have already spoken of the lesions met with in the walls of callous ulcers of the lesser curvature.

3 *True Duodenal Ulcer*—Under the name of true duodenal ulcer, Mathieu has described the ulcers seated upon the duodenum at a distance sufficiently great from the pylorus to ensure that the pylorus is neither involved in the ulceration nor invaded by a peri-ulcerous inflammatory process which may give rise to the phenomena of spasmodic stenosis of reflex origin. This true duodenal ulcer is rare, according to Mathieu, it is met only in the proportion of 1 to 10 as regards gastric ulcers. Men are much more often attacked than women, 75 per cent of men. This duodenal ulcer progresses by paroxysmal attacks more or less prolonged, separated by intervals of calm of variable duration. The general symptoms of this ulcer are both of the pain and the bleedings, as Bucquoy has already pointed out, the pain of variable intensity coming on generally three or four hours after the meal, seated sometimes in the epigastrium and sometimes more frequently in the hypochondrium, whence it radiates to the base of the thorax. The pain may be provoked or made worse by palpation of the abdominal wall to the right of the median line. The pain is often relieved in the beginning of the malady by the ingestion of food, but this phenomenon follows no longer in the more advanced evolution of the ulcer, and at the same time the hour for the pain becomes more irregular, then ceases to be noticeable. Hemorrhages manifest themselves especially under the form of melæna of variable intensity, coming often in the midst of apparent health and sometimes entailing profound anæmia. When true duodenal ulcer is not accompanied by cicatricial

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stenosis, which is most frequently the case, there exists none of the phenomena of gastric retention (early alimentary stasis) These symptoms are not very characteristic If they should occur and be well marked, the existence of a duodenal ulcer may be seriously suspected

4 *X-ray Examinations*—The X-ray examination has become a necessary complement to the purely clinical examination This examination should always begin by a radioscopic study of the stomach This gives us general information as to the form of the stomach, its mobility, upon the site of points painful to pressure, upon its method of emptying itself It also enables us to distinguish from true bilocular stomach certain false biloculations which one observes quite frequently in prolapsed stomachs

Thus, as Leven and Barret have well shown, it is sufficient to press in these cases upon the lower part of the organ in order to see the contracted part expand and demonstrate thus the absence of true mediogastric stenosis Radiography only enables us to preserve the image of certain pathological alterations which one must study further Contrary to cancer, whose presence is revealed by the existence of a gap-like image, ulcer, so far from making any projection into the cavity of the organ and there displacing the ingested bismuth, creases rather the gastric wall and may betray itself by a dark stain, its cavity being filled with bismuth These stains upon the gastric wall are, however, only rarely detected and have no great practical importance On the contrary, the diverticular recesses (notches) of the gastric wall, described by Haudeck, have considerable importance We have seen them many times with the greatest clearness and operation has verified in these cases the existence of a deep ulcer invading the gastric wall, or a penetrating ulcer To see these notches of Haudeck it is sometimes necessary to examine the patient in profile, the shadow thrown by the bismuth being able to mask that of a diverticulum which would not appear well marked except in an oblique position The aero-bismuth diverticulum of Haudeck characterized by a light stain superimposed upon the dark stain of the diverticulum, is characteristic of ulcers penetrating into a neighboring organ In order to avoid errors, it is necessary to take care to mobilize the stomach while the patient is before the screen One may determine thus the fixedness of the diverticular recess and often, also, one may observe that there exists a fixed painful point corresponding exactly to the seat of the diverticulum

As to ulcer of the duodenum, we have never observed stain nor recess visible by radioscopy. Besides, it is admitted by those who have the most experience in these examinations with the screen that radiographic examination of duodenal ulcers is difficult. Holzkecht has recommended to inject bismuth directly into the duodenum by means of a tube and to compress afterwards with a special tampon the duodenojejunal angle. This delicate manoeuvre complicates very much the examination with a screen and increases proportionately the chances of error.

The form of the stomach may be modified by the presence of an ulcer, so that with respect to an ulcer of the lesser curvature there may exist a spasm of the opposite gastric wall which will give on the screen the appearance of gastric biloculation really non-existent. Methodical palpation of the stomach during the examination will enable us sometimes to recognize that this biloculation is only intermittent, or is easily overcome. It is well to note that there are sometimes persistent spasms which produce a real bilocular stomach.

The true bilocular stomach due to mediogastric stenosis following ulceration may usually easily be recognized on the screen. In the most typical cases one sees the two pockets, cardiac and pyloric, unequally filled with bismuth and separated by a canaliculated zone of fixed constant dimensions. It is not very rare to see the recess of Haudeck at the level of the contracted zone. Generally the canal which joins the two pockets lies near the lesser curvature. When a mediogastric stenosis is close, the bismuth remains a certain time in the upper pocket, it appears as a small sac hung below the diaphragm, then the bismuth descends slowly into the inferior pocket.

Close pyloric stenosis produces a total dilatation of the stomach with deformity of the normal shadow of this viscus. There is, in fact, a considerable enlargement of the organ in its transverse diameter, the shadow in enlarging extending to the right of the median line, well limited below, surmounted by a grayish zone (the intermediary layer of Bécclère). This zone corresponds to the presence of retained liquid which separates the bismuth shadow from that portion of the pocket filled with air, always situated in the upper part of the stomach. Often in these cases of great gastric dilatation the bismuth shadow does not rise as far as the pylorus which remains invisible.

In certain callous ulcers of the lesser curvature one may see a kind of folding together of this region which deforms the stomach, bringing together the cardia and the pylorus.

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Extensive perigastric adhesions (adhesive perigastritis) may sometimes declare themselves upon the screen by the immobility of a more or less extended portion of the organ, or by the appearance of the bismuth shadow which, in place of being regular, presents an irregular appearance.

The modifications of the motility of the stomach due to an ulcer, active or cicatrized, may also be observed in certain cases by radio-scopic examination

When the pylorus is contracted or in a state of spasm, but still permeable, there exists an exaggeration of the peristaltic movements of the stomach. The pylorus is much contracted, the stomach dilates transversely and the evacuation of the bismuth emulsion is extremely slow notwithstanding the exaggeration of the peristalsis. In certain cases antiperistalsis is produced, the recurring waves moving in a direction opposite to the normal and alternating without regularity.

German authors incline to admit that generally in gastric ulcer the passage of bismuth is slow and that, on the contrary, in true duodenal ulcer it is accelerated. One can verify especially well these phenomena by having the patient swallow a small quantity of a solution of hydrochloric acid, 5 to 1000. This phenomenon is explained by pyloric spasm which exists almost always in gastric ulcer and is wanting, on the contrary, often in true duodenal ulcer.

Finally, it is necessary to add that radioscopy in permitting us to control the results of operations upon the stomach and duodenum has rendered inestimable services of which it is wise never to deprive one's self.

IV SURGICAL TREATMENT

A TREATMENT OF COMPLICATED GASTRIC AND DUODENAL ULCER —
I Perforation — It is useless to insist upon the absolute necessity for the most rapid possible surgical treatment in cases of perforating gastric or duodenal ulcer. It is known that perforation may take place into the free peritoneal cavity, or, on the contrary, into a peritoneal zone already protected by adhesions. In the first case, rapidly progressive diffuse peritonitis is inevitable, to combat which it is necessary above all things to thoroughly close the perforation. According to the case, one will practise excision of the perforated ulcer, followed by suture in two planes to the loss of substance in the parietes of the stomach or simply an infolding of the perforated ulcer when excision may appear impossible or too difficult. Plastic use of the epiploon may be serviceable in these cases to reinforce a doubtful suture. Simple damming by

a tamponade of gauze around the perforated zone with drainage is only a *dermer resort*, which should be resorted to only in cases of absolute necessity. This proceeding, however, has enabled us to save a patient whose perforation, very highly situated, was almost inaccessible.

When the general state of the patient will permit it, an immediate posterior gastro-enterostomy appears to us to be good practice. One of us (Lecene) has practised it 4 times with 4 successes. This complementary gastro-enterostomy is above all indicated when the perforated ulcer occupies the pyloric or duodenal region, for sutures then often produce constriction at the region near the pylorus.

Treatment of the peritonitis itself will be instituted according to the rules accepted to-day by the majority of surgeons: suprapubic drainage by a small special incision, immediate closure of the abdominal wall to the level of the epigastric region, the sitting position of the patient in his bed, the back sustained by a rest and the head of the bed raised, enteroclysis in salt solution in large quantity. This is, in fact, the American method for the treatment of acute peritonitis applied to the treatment of perforations of the stomach and of the duodenum. Lavage of the peritoneal serous surface as a part of the operation does not appear to us to be indicated in all cases. This lavage seems to us to be necessary only to remove mechanically food masses sometimes met with in the seropurulent exudate of the peritoneal cavity. In these cases, as in all other cases of peritonitis from perforation, the great factor of success is early intervention. This all statistics show.

Of 202 operations for peritonitis from perforating ulcer of the stomach, that we have gathered, we find that of 96 operations done in the first 12 hours, 38 deaths resulted (39 per cent), of 64 operations done between 12 and 24 hours, 35 deaths (56 per cent), of 42 operations done between 24 and 58 hours, 34 died (81 per cent).

When perforation has taken place into an area already protected by adhesions, there is produced, as a general rule, a subphrenic abscess. Of 890 cases of subphrenic abscess, collected by Piquand, in 234 cases the cause of the suppuration was a gastric ulcer which in 191 instances was seated near the pylorus, and in 36 cases there was present a perforated duodenal ulcer. Incision of the subphrenic abscess follows naturally as soon as the diagnosis is established. The evacuation of the pus may often suffice to bring about cure, but a grave complication may be noted once the abscess cavity is evacuated and drained, that is the formation of a fistula opening into the stomach or the duodenum.

When this evil complication occurs the life of the patient is seriously threatened, if the food escapes externally in abundance, death from inanition supervenes. These cases are happily rare. When the fistula connects with the duodenum, it is better to practise a gastro-enterostomy with exclusion of the pylorus, as Berg, Moynihan and Knaggs have done. If it is the stomach itself which is involved, the course to pursue is more delicate. It seems in these cases it would be well to attempt resection of the perforated gastric wall or to do an immediate suture, notwithstanding the risk of having the suture fall, or one could make a jejunostomy.

2 *Hemorrhages*—Hemorrhage may be considered as a complication of gastric or duodenal ulcer only if it is very abundant, or if it is often repeated. In case of large hemorrhage coming on abruptly, the surgeon should restrain himself, as one of us has already expressed it in 1902. In fact, if, theoretically, the indication to ligate the bleeding point is clear, practically its performance is attended with much difficulty. The opening of the stomach and the minute exploration of the mucous surface of the organ constitute a complex surgical interference which can only be born by an individual of great resisting power. A bleeding erosion may be difficult, or even impossible, to discover during life. An ulcer may be accompanied with such infiltration and such friability of the neighboring tissues that the placing of a reliable ligature is impossible. So much for the reasons which militate against the immediate intervention in a patient in a state of shock and acute anæmia.

The results of interventions which have been attempted in these cases have, moreover, been very bad. 25 deaths in 42 patients, *i.e.*, 64.2 per cent, according to the statistics of Mayo-Robson. This figure agrees with our own statistics together with those of Mikulicz and of Czerny (63 per cent). Death, moreover, supervenes only in exceptional cases, when the patient is immediately immobilized and put on an absolute diet. It has occurred to us to see patients get well, who had become blanched by such bleeding.

On the other hand, when the hemorrhages are repeated and provoke a profound state of progressive anæmia, surgical intervention is indicated. There should be made on the preceding day, or followed immediately by, a blood transfusion which in such cases finds the happiest indications. The character of the intervention will vary according to the situation of the ulcer. If this is at the pylorus and provokes signs of stenosis, gastro-enterostomy gives often good results.

and appears to us to be the operation of choice. It suppresses the contractions of the stomach made violent by the exaggeration of the habitual peristalsis in such cases and in a large measure will place the stomach at rest, whereby the formation of a clot is favored.

If the ulcer is plainly duodenal, gastro-enterostomy completed by pyloric exclusion is very rational and has given good results. When the ulcer is gastric, but is not seated near the pylorus and does not produce the accidents of stenosis, gastro-enterostomy produces little or no influence upon hemorrhage. One can have recourse in such cases to ligature of the vessels in the neighborhood of the ulcer, in a case of pronounced anæmia consecutive to repeated hemorrhages which originated in a callous ulcer of the lesser curvature, we have ligated the gastric coronary artery and the pyloric artery and had the patient recover. When the state of the patient may permit a more serious interference one may resort with advantage to excision of the ulcer followed or not by a gastro-enterostomy.

Jejunostomy which secures an absolute rest of the stomach and of the duodenum has been done in these cases (Eiselsberg, Moynihan, Loyal).

Personally, we have no experience in jejunostomy practised for this particular indication.

3 *Cicatricial Stenoses*—In stenosis of the pylorus consecutive to cicatrization of an ulcer, a pyloroplasty has been advised. Even with the modification of Finney, pyloroplasty does not appear to us to be a method of interference to be recommended rather than gastro-duodenostomy. Theoretically, it has certainly some advantages, but in our opinion it has a capital fault: the intervention is made too near the diseased region near which there may still exist ulcerating lesions undergoing development. This operative method has also the inconvenience that it does not exclude the alimentary circulation from the duodenum, which can still be the seat of an active ulcer below the point where the operation is done. Personally we have never had recourse to a pyloroplasty and we have always contented ourselves with gastro-enterostomy, the results of which are excellent and give to patients, the subjects of pyloric stenosis from ulcer, practical resurrection. In a single case we have regretted not having done at the same time as the gastro-enterostomy an excision of the pyloric region, this was in a patient suffering from a callous ulcer stenosing the pylorus, upon whom we did a gastro-enterostomy, in November, 1899. After four years of perfect health this patient died of a gastric cancer. It

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is evident that this patient would have been benefited by a pylorectomy at the first operation. We have resorted to pylorectomy in many other cases of pyloric callous ulcer. We advise this method of proceeding for this particular condition. One point to which we desire to call attention is that in these pylorectomies for ulcer, it may be dangerous to finish the operation by a duodenogastric implantation, after the method of Kocher. The pyloric ulcerous lesion may, in fact, be accompanied by an analogous lesion in the duodenum, and this is not excluded from the alimentary tract. One of our patients, after a pylorectomy followed by a duodenogastric implantation, has succumbed from a very great bilious regurgitation which we were not able to explain to our satisfaction. At the autopsy we found present below the ampulla of Vater, an ulcerous stricture of the duodenum which we had overlooked at the time of the resection of the callous ulcer of the pylorus. So we think that in these pylorectomies for ulcer gastro-enterostomy with closure of the two ends is to be preferred to duodenogastric implantation. Though indicated in callous ulcers, pylorectomy is unfortunately not always technically possible because of extensive adhesions and inflammatory conditions in neighboring organs. It has been suggested, in such case, to resort to exclusion of the pyloric region (Eiselsberg). We have never personally practised exclusion of the pylorus in these cases. Exclusion of the pylorus does not protect a callous ulcer from secondary cancerous degeneration which is, indeed, the great danger of the future, so that this method of operating does not seem to us very rational.

Stenosis of the duodenum by cicatrization of an ulcer, much more rare than pyloric stenosis, seems to us to call for the same treatment, gastro-enterostomy. Duodenoplasty, an operation technically difficult and uncertain as to the future, appears to us still less to be recommended than does pyloroplasty.

Mesogastric stenosis by ulcer giving rise to the well-known hour-glass deformity calls strongly for surgical treatment. Numerous procedures have been recommended for the surgical treatment of bilocular stomach. It is, however, certain that there is no one procedure applicable to all cases, so that one must be governed in each case in his choice of procedure by the anatomical conditions. If mesogastric stenosis is not accompanied by pyloric stenosis, and, if the ulcerous lesions have not provoked about the affected area too extensive adhesions to neighboring organs, it seems to us that the most satisfactory operation and the surest is partial resection of the stomach followed

by end-to-end anastomosis of the two gastric segments. When it is possible such partial gastrectomy is in these cases a very good operation, giving perfect functional results, we have resorted to it three times with excellent result.

But when pyloric stenosis coexists (which is rarely), or when adhesions around the contraction are such that partial gastrectomy is impossible, it is necessary to resort to other methods. It has been proposed in such cases to make a gastroplasty, an operation based upon the ancient pyloroplasty, a longitudinal section of the stenosed zone sutured vertically. It is a bad operation which has given numerous failures. This method has the very grave fault of placing the sutures in the area of diseased tissue and it is open to the same objections as pyloroplasty. In one of our patients this gastroplasty which appeared to have given an immediate satisfactory result was followed by recurrence and we had to reoperate. Gastroplasty should, then, be rejected. A wide anastomosis between the two pockets, cardiac and pyloric, always supposing the presence of a normal pylorus, is an operation much more satisfactory when it is anatomically possible. That is to say, when the two pockets, cardiac and pyloric, are sufficiently large and sufficiently mobilizable to permit suture without traction. Such gastrostomy is a good operation which has given us successful results and which we recommend.

When the pylorus is contracted, none of the operations of which we have just spoken are possible. It is necessary then to have recourse to gastro-enterostomy practised upon the cardiac pocket when it is large, the pyloric pocket being small. Gastro-enterostomy has given us in such cases very good results. When the pyloric pocket is quite large, a two-fold gastro-enterostomy may be done, the one upon the cardiac and the other upon the pyloric pocket.

4 *Perigastritis*—It is not exceptional to meet with patients who have presented signs of gastric ulcer and who, notwithstanding the healing of their ulcer, continue to suffer from the lesions of perigastritis. In these cases surgical treatment may be indicated. When the adhesion which unites the stomach to neighboring organs, as the liver, diaphragm, abdominal wall, is limited, and when the gastric ulcer appears well healed, the simple section of the adhesion has given success, but when diffuse adhesions exist, or when a gastric ulcer is still active, such gastrolisis is an operation which is accompanied by numerous difficulties. The liberation of the adhesions is in these cases very often followed by reproduction of the same adhesions. To hinder the ad-

hesions from reforming there have been employed iodoformized vaseline, the oil of vaseline, olive oil and liquid lanoline. It is impossible, really, to pronounce upon the value of these procedures which have been employed upon the living patients Mayo-Robson has proposed to insert between the bleeding surfaces the free border of the great omentum, one can quickly make in such cases a true epiplooplasty; we think that an accurate hæmostasis and a very exact covering with peritoneum for the bleeding surface makes the best means we have had at our disposal for hindering as far as possible reproduction of liberated adhesions. If simple gastrolysis has failed, it has been proposed to add to it either a gastro-enterostomy or an excision of the zone where the ulcer was seated. In one patient gastrolysis and gastro-enterostomy practised at the same time gave us a result at first favorable, only to be followed by a reappearance of trouble. The patient presented a new alimentary stasis and the operative result was incomplete. This fact shows how necessary it is to be conservative in one's judgment of the results of the operations for extensive adhesive perigastritis by which the stomach has been deformed and its functions seriously interfered with. One can understand how, in the presence of repeated failures in certain cases of extensive perigastritis, some surgeons advise recourse to extensive gastric resection.

5 *Ulcers Which Have Undergone Cancerous Degeneration*—We do not speak of ulcerated cancers, the therapeutic indications are the same as in any case of cancer of the stomach whether or not following upon an ulcer.

B TREATMENT OF NON-COMPLICATED GASTRIC AND DUODENAL ULCER—I *Gastric Ulcers and Duodenal Ulcers with a Pyloric Syndrome*—The operative indication seems to us to be the same in all ulcers situated in the vicinity of the pylorus whether they are seated in the stomach or in the duodenum, when these ulcers are accompanied by a pyloric syndrome and they have proved resistant to medical treatment. Clinically, as we have already said, it does not appear to us possible to make a differential diagnosis between gastric pyloric ulcer and duodenal ulcer.

Surgical intervention will begin always by a careful exploration of the whole pyloric and duodenal region, whereby the exact seat of the ulcer is determined. When it is possible, we practise the operation which appears to us to be much the most simple and the most certain, namely, gastrojejunostomy. We do it posteriorly through the mesocolon with a very short jejunal loop. We attach very great importance

to placing the gastric orifice of the anastomotic opening upon the pyloric antrum itself at its most dependent point quite near the great curvature. We always employ sutures, never the anastomotic button. The sutures, silk or linen, are arranged in two planes, the deep suture, including the whole of the gastric and intestinal tunics, is at the same time occlusive and hæmostatic, the superficial suture, seromuscular, covers in completely the deep suture and protects it. We never use clamps and we open the visceral cavities with the bistoury, seeking to make clean incisions. We think it is very important to observe these technical details in order to avoid the formation of secondary peptic ulcers at the orifice of communication or within the jejunum. It is quite certain that persistent hyperchlorhydria plays a primordial role in the genesis of this grave complication of gastrojejunostomies, but its action seems to us facilitated by every traumatism of the gastric and intestinal walls in the course of the operation.

It has been said that the gastro-enterostomy does not act as a mouth as long as the pylorus is permeable. Some have even gone further and have claimed that the mouth not only does not functionate, but contracts, and finally becomes obliterated. We cannot agree with such assertions. A gastro-intestinal orifice well covered with mucous membrane without cicatricial tissue, cannot become obliterated even if nothing passes through it. Such obliteration would be contrary to the laws of general anatomy and we are surprised that such an error has been advocated. Careful analysis of the published cases of obliteration shows besides, as Hartmann has established, that these obliterations are due to the development of ulcerative processes affecting the borders of the anastomotic mouth, followed by cicatricial stenosis. They have been observed as well in cases of pyloric stenosis as in those of permeable pylorus. There is no longer any dispute possible upon this question.

As to the physiological failure of the gastro-enterostomy mouth to functionate in cases of permeable pylorus, it would seem to have been established by the experiments of Kelling, in Germany, and of Delbet, in France. These authors have not in our opinion taken sufficiently into account in their experiments the exact anatomic seat of the anastomotic mouth. The stomach may physiologically be considered to be formed of two portions, the cardiac and pyloric portions. The latter is essentially the motor part of the organ. When the gastro-enterostomy opening is established upon the cardiac portion, which in the dog is the part that immediately presents to the operator, the largest part of the

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gastric contents is, in fact, evacuated through the pylorus. When, on the contrary, one takes care to make the anastomosis upon the pyloric antrum, the gastric contents pass almost entirely by the anastomotic opening. This is shown by experiments, as yet unpublished, upon the dog by Hartmann and Métivet.

Radioscopic observations made upon our old patients by our former interne, Wolfrom, have established that this is so, also, in man. Upon a series of patients upon whom we have done a gastro-enterostomy, and who presented before the operation neither stenosis nor alimentary stasis, Wolfrom has been able to show that the bismuth mixture passed almost immediately after its ingestion through the gastrojejunal opening, after only a certain time a small quantity of the bismuth found its way through the pylorus. The proper conclusion from this is that we should systematically make the anastomotic opening upon the pyloric antrum.

In cases of ulcer seated clearly upon the duodenum, we have never practised true exclusion of the pylorus by division and obliteration of the two ends. In some cases only, we have retrenched the pylorus by plicating it vertically according to the procedure of Doyen, praised by Wm Mayo and termed by him "blockage," this blocking sufficing to hinder all passage from the stomach into the duodenum, as we have determined in an autopsy.

The pyloric exclusion is counselled by a certain number of surgeons and there have been devised for its practice numerous procedures. Blockage of the pylorus has been, as we have just said, advised by Doyen in 1893. Here is what Doyen wrote at that time: "We invaginate with the finger into the duodenum a small part of the walls of the stomach which we fix by three or four points of suture. We fill up, thus, the pylorus from in front by this small invagination, suturing its inferior and superior borders together by a longitudinal suture, either continuous or interrupted."

This process of blockage may give us the results sought for, as we have said. It is simple and rapid. It seems to us easier than the submucous process of Girard (1911). This is an inverted pyloroplasty. A vertical incision is made on the face of the pylorus not involving the mucosa, the lips of this incision are dissected up and the wound in the gastric wall is sutured horizontally, having been transformed into a lozenge shape by horizontal traction. Complete exclusion of the pylorus can be realized with absolute certainty only by the complete resection of the pyloric antrum of the stomach followed by a closing suture of each

cut end We think that the simple blockage may very often be sufficient for the physiological exclusion of the pylorus, if one wishes, on the contrary, to obtain positive exclusion, it is to the procedure of complete section followed by a closure of each cut end that recourse must be had, but such complete exclusion thus done has the inconvenience of prolonging notably the operation and seems to us to be recommended only in cases of very positive indication

2 *Duodenal Ulcers*—As we have already said, we think that, as a general rule, gastro-enterostomy followed, or not, by a simple blockage of the pylorus, or a complete exclusion according to the case, suffices to ensure the complete evacuation of the stomach and to set at rest a duodenal ulcer Is it necessary in certain cases to have recourse to excision of the duodenal ulcer with or without consecutive duodenoplasty? Jaboulay made formerly this excision with duodenoplasty Wm J Mayo has also done a large number of such excisions of the duodenal ulcer (52 times) without gastro-enterostomy The results have been very good, both immediate and later

This excision of the duodenal ulcer does not appear to us, in general, to be much indicated It complicates notably the intervention and it does not appear evident that it gives better results than simple gastro-enterostomy with exclusion of the pylorus However, if the duodenal ulcer is very easily accessible, and above all if a perforation seems imminent, excision may be resorted to, and yet, in such cases, would it not be better to bury widely the ulcer by infolding the duodenal wall? Our personal experience is not sufficient to enable us to decide upon this point

3 *Non-pyloric Gastric Ulcers*—When the gastric ulcer is seated some distance from the pylorus, a simple posterior gastro-enterostomy may still give good results It seems, indeed, that it especially acts in such cases through a partial neutralization of the gastric acidity, due to the flow of the bile and the pancreatic juice into the stomach The slight reflex into the stomach of the jejunal contents, which one observes constantly after gastro-enterostomies, far from being injurious to the patients, constitutes, on the contrary, one of the elements of success of the operation

It is, however, proper to recognize that gastro-enterostomy does not give constantly favorable results when the ulcer is seated a certain distance from the pylorus Thus, in one of our patients upon whom gastro-enterostomy was done in 1908, all trouble disappeared for two years and the patient increased in weight, 15 kilogrammes Then the

pains reappeared, at first slight, then more and more severe until in July, 1913, the patient presented herself again emaciated and suffering much, and the radiograph demonstrated clearly an ulcer of the small curvature with the notch of Haudeck. The gastrojejunal mouth was working well.

The failures of gastro-enterostomy are specially frequent in cases of callous or penetrating ulcers which occupy by preference the small curvature or the posterior face of the stomach. It is in this class of cases that excision of the ulcer presents itself for consideration. This ablation of the ulcer appears so much the more indicated in rebellious callous ulcers which are those that present quite often lesions of secondary cancerous degeneration.

We have never practised excision of the ulcer by the transgastric path which has been done a certain number of times by W. J. Mayo. The only operations to which we have had recourse have been the excision of ulcer of the lesser curvature, partial resection of the stomach with terminal anastomosis and partial gastrectomy with closure of the two cut segments, and gastro-enterostomy.

The great reproach which has been made against this excision of ulcers, of gastric resections for callous ulcers, is that they are followed by a great mortality. This is, in fact, at least 10 per cent. Payr, who has recently, in Germany, with Riedel and Kuttner defended these gastric resections for callous ulcers, found 10 per cent of mortality out of a total number of 465 cases of excision or of resection for ulcer collected in the literature. The personal statistics of Payr were 2 deaths in 30 cases, the Brothers Mayo have had to deplore only two deaths in 78 operations, 38 excisions and 40 resections. This showing is particularly favorable. One may then hope that as the technic is perfected, there may be reached a notable lowering of the mortality of these resections for ulcer. What the operative technic shall be is then of major importance. It will naturally vary according to the case.

Simple excision of the ulcer and its thickened borders to a sufficient extent, followed by suture of the stomach, is to be recommended only if the ulcer is neither too extensive nor too adherent and especially when it occupies a region of the stomach easily accessible, as, for example, the anterior face of the organ or the great curvature, but we know that these are exceptional points of localization for gastric ulcer, above all when it presents the anatomical form called callous ulcer. After these simple excisions it is then wise to make a complementary gastro-enterostomy, for one may have left behind a small ulcer little visible

and it is always indicated to drain the stomach and to place that organ at rest

When the callous ulcer is seated at the level of the lesser curvature, a frequent occurrence, two conditions may present themselves practically, either the callous ulcer is little adherent, simply accompanied by sclero-œdematous infiltration of the lesser epiploon, the stomach remaining movable, or the stomach adheres posteriorly, presenting the anatomical type described as penetrating ulcer. In the first case, when the stomach after careful exploration of the postomental cavity by invagination of the gastrocolic ligament can be well mobilized and drawn out, one can practise saddle-shaped resection of the lesser curvature. This operation in cases where it is anatomically practical gives a very good immediate anatomical result. My experience has shown that it is capable of giving lasting functional results. The only precaution to take in these cases is to make a satisfactory suture, performing, indeed, a true gastrogastrostomy between the segments. It is the only way to avoid considerable malformation of the stomach, which would be produced by any other kind of suture of the gastric breach created by saddle-shaped excision of the lesser curvature.

When, on the contrary, callous ulcer is of the penetrating type, or when it is firmly adherent behind the stomach and cannot be drawn out, it is quite necessary, if one has decided to remove this ulcer, to make a typical total segmentary resection of the stomach, as described by Riedel and Payr. After total vertical section of the stomach more or less near the pyloric antrum, one takes away the proximal gastric strip and detaches the posterior adhesions. In case of ulcer penetrating only the pancreas, practically a frequent occurrence, the opening of the stomach is inevitable at this point in the operation. There is left in place the bottom of the ulcer which is formed of the pancreatic tissue. This surface should be cauterized and with careful drainage of this infected zone with its doubtful vitality, one may obtain success. Riedel, Payr and Kuttner have demonstrated this and we have had occasion to practise it twice successfully. Acquaintance with the operative technic is important for often operators hesitate to resect such an ulcer from its adherent point. The liberation posteriorly having been completed one may draw out progressively the proximal portion of the stomach and make a total vertical section of it at a point judged convenient. It is necessary in these gastric resections to use great care in the hæmostasis of the cut edges. The stomach in these cases is very vascular, congested and bleeds much more easily than in cancer. It is

better to ligate separately the great trunks which spurt along the gastric edge and it would be imprudent to depend for hæmostasis only upon the general overcast suture which may become relaxed through gastric peristalsis. According to the extent of the resection and the possibility of bringing together the two gastric edges, one may decide then to finish the operation either by end-to-end anastomosis of the two gastric ends, or by separate closure of these two ends followed by gastro-enterostomy upon the cardiac pouch. True, these operations of resection of ulcer, often extensive and complicated by posterior adhesions, are not always simple, but taking into account the gravity of callous ulcers of this region and the frequency of the later development in them of neoplasms, it is of great advantage to practise it. We are persuaded that here the surgery of the future will establish proper indications and technic.

THE DIAGNOSIS OF GASTRIC AND DUODENAL ULCER *

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THE extent to which surgical operations in cases of gastric ulcers may be successfully performed depends chiefly upon our ability to diagnose. Progress in the last decade does not lie principally in the field of intense cicatricial contraction, of gastric hemorrhages and of acute perforation, *ie*, of those diseases which could readily be recognized as early as two decades ago, but rather in the realm of the extra-pyloric gastric ulcer and ulcers of the duodenum, *ie*, cases which, unless accidental bleeding or acute perforation set in, had heretofore been regarded as "gastralgias" and "gastric neuroses" and treated in various baths and nerve sanatoria. In spite of the fact that an occasional ulcer had been surgically treated before the introduction of the Rontgen rays, nevertheless a definite and systematic plan of procedure could only become a genuine possibility after their introduction, substituting, as it did, the benefits of clear vision for uncertain conjectures and theoretical deductions. Progress thus made manifested itself not only by the ever-increasing number of operations for gastric and duodenal ulcers actually performed but also by the great number of published articles appearing in this newly discovered field of activity.

Other benefits derived by X-ray examinations even surpass the advantages naturally obtained through diagnosis made *ante operationem*. The X-rays enable us, in a manner heretofore impossible, to discover the causes of immediate post-operative disturbances and subsequent ill effects thereof, and furthermore to exercise a certain self criticism formerly too often supplied by the internist, which, though sometimes just, was too frequently lacking in any sure foundation.

It may be said in advance, that in the present paper essentially only those methods will be referred to, which are generally available in surgical practice. First, we lay great stress upon the taking of a series of radiograms which fix the most important phases of the process of digestion. Our proceeding is the following

* Read before the International Society of Surgery, April 14, 1914. Translated from the German by Dr. Oswald Joerg.

Immediately after the patient has taken 400 grammes of a sufficiently liquid carbohydrate-contrast meal (without milk!), photographs are made, one in the upright position, one in the abdominal position, and one in the right lateral presentation. After 2 and 6 hours subsequent photographs in abdominal position, less often in upright position, are taken. Again photographs after 24, 48 hours and so on, until the bowels are empty from contrast substances. These latter sittings are always taken, if after 6 hours there is still a considerable residue in the stomach and, further, if a disease of the bowels is in question.

We are unable to reconcile ourselves to the double meal recommended by Haudek, at least not as a rule. The advantage which it offers, namely, to require the patient to come but once, is in very many instances amply counterbalanced by the disadvantage, that in consequence of the double introduction of contrast substances the further following in the intestinal canal gives no useful results. We prefer to examine first the process of digestion in the whole gastro-intestinal canal through a regularly carried out series, and later on to make a series of control photographs where they appeared desirable as a result of the first series. Frequently the first series itself gives us the desired information. It is certain, that for the purpose of future documentary evidence and control investigation the examination of a single contrast meal is greatly to be preferred to the principle of the double meal, even though the latter should be less difficult for the moment.

The most important questions concerned are the following

I What forms of gastric and duodenal ulcer can be positively diagnosed and which are still resistant to our diagnostic resources?

To answer these questions, the different forms of ulcer must be reviewed separately.

A The Non-stenosed and Non-perforating Gastric Ulcer —As long as such an ulcer did not manifest itself by hemorrhages or acute perforation, the diagnosis was until recently but a diagnosis of conjecture, and we can safely say, looking at the operative observations and the findings of autopsies, that many gastric ulcers were not diagnosed and some of those diagnosed were not present. Has the Röntgen picture brought about a change in this? At best only with restrictions. Of course, we became acquainted through it with a symptom which is often found in ulcer, *i.e.*, *the localized spasm of the gastric wall at the site of the ulcer*. The pylorospasm known for a long time as the result of an ulcerating process finds its analogue in ulcers situated at any point in the gastric wall. This localized spasm differs from the

sometimes very intense contractions attending peristaltic waves, as a rule, by constricting the stomach only along the greater curvature. The chief reason for that may be that the ulcers are mostly situated at the lesser curvature. But it is remarkable that I never had occasion to see a corresponding contraction from the lesser to the greater curvature. A further diagnostic sign is, that in ulcer, we always find the spasm at the same place, while we find the contraction of the peristaltic waves, even if it should concern more the greater curvature than the lesser, at different places at different examinations.

A further attribute, which these spasms have in common with the other spastic conditions of the stomach, is that the spasm is not a lasting one. If we inspect such a stomach at the operation, when it is mostly empty, it may be that there is no indication of a spasm at all, even though the stomach had appeared in the Rontgen picture to be bipartite. The spasm, on the contrary, appears, if material is introduced into the stomach, be it only air blown into it (Roepke). It can be made more or less to disappear by the use of atropine or papaverine.

There now arise two further questions important for diagnosis.

1 Does such a spasm only occur in *ulcers*? We have to answer this question in the negative. Stable spasms may arise also without ulcers at the base of the cicatrix after operation or as the result of other anatomical anomalies such as cicatricial bands, even, but very seldom, from the pressure of a corset. Immediately after operations they are, as we will see later on, very frequent. On the contrary, they seem to be very rare in the sharply circumscribed form which attends ulcers, always arising at the same place, in stomachs not yet submitted to an operation. The non-ulcerated gastrosplasm, lately more accurately described by Holzknecht, seems to involve mostly larger sections of the stomach.

From the existence of narrowly circumscribed spasms arising after each supply of food we can conclude with certainty that there exists an ulcer of corresponding location. The ulcer itself is delineated in the Rontgen picture only if it has clearly eroded a part of the gastric wall beyond the submucosa so that it is about to become a perforating ulcer.

2 Do we find these spastic conditions in *all gastric ulcers*? Here again we must answer, *no*. We have seen very many pronounced gastric ulcers in which the spasm under ordinary conditions of its appearance was wanting or scarcely to be observed. There are certainly here, too, individual "spasmophil" tendencies (Haudek). For instance, in one of our female patients after transverse resection of the stomach on account of an old ulcer complicated with spasm of high degree with well restored gastric function, a very obstinate *cardiospasm* set in.

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In what percentage circumscribed spasm occurs in gastric ulcer is entirely beyond our knowledge, for the spasm is for many cases the only objectively traceable sign of an ulcer. If it is wanting, the ulcer lacking other clinical points can simply not be diagnosed.

It follows from the aforesaid that the progress which we have made in the diagnosis of the non-penetrating gastric ulcers from the Rontgen examination, is only a relative one. Even this is a gain in a sphere in which we have to be grateful for every new diagnostically recognizable sign.

Our ability to diagnosticate gastric ulcer will perhaps at some time be furthered in an important degree by examination of stomach with a gastroscope. But its technic is still in the developmental stage, although some have succeeded in actually seeing ulcers. We must add that this method of investigation for gastric ulcer may not be quite without objection in view of the danger of bleeding and perforation. Fortunately, the imperfections of our diagnostic resources in this particular class is not so grave, because gastric ulcer, neither penetrating nor stenosed, as long as it does not cause hemorrhages, does not happen to be the object of surgical interference, but is left for internal treatment.

It will be very rare that, as Petren and Elgin stated not long ago, a non-penetrating, comparatively recent ulcer gives a niche-forming Rontgen picture through the mere projection of its rarefied base.

Special interest attaches to *non-stenosed and non-penetrating ulcers of the pyloric region*. Mediogastric spasms do not materially impair the onward flow of the contents of the stomach, but such impairment is the case in a higher degree with spasms at the pylorus.

The possibility of a pyloric ulcer is to be considered if with the clinical symptoms of ulcer (pain, hyperacidity, hypersecretion) there is a considerable residue of the carbohydrate-contrast meal found present over 6 hours after its ingestion. This 6 hours' residue is, it may be said, of diagnostic value only when the test meal was a pure carbohydrate-contrast meal, and contained no albumen (milk) nor fat, and if during the first 6 hours neither a further meal nor more fluid were introduced into the stomach. A 6 hours' residuum, caused by purely functional disturbances, can be found, it is true, under the following conditions:

a In purely functional diminished mobility, especially in connection with ptosis. The stomach shows in these cases a diminished peristalsis.

b In pylorospasm excited by an ulcer remote from the pylorus. Sometimes there is found in penetrating ulcers at the lesser curvature a

considerable retardation in the removal of food from the gastric section situated beyond the ulcer. This delay is explained by some radiologists as due to a reflex pylorospasm, an explanation which is corroborated by our own observations. Nevertheless, it may be remarked that Faulhaber, on the ground of his experience, denies emphatically the retardation in the exit of food as, of course, also the theory of a pylorospasm due to a distant cause. The retardation in the exit of the food from the stomach can, at any rate, be explained in the sense of a pylorospasm, if it is not caused by a mechanical impediment in the region of the ulcer itself (hour-glass contraction of the stomach) and if the pylorus is not so much distorted by the perigastric process of cicatrization, as to produce a mechanical impediment. It is just this latter point to which little attention has been paid in the theory of reflex pylorospasm. We shall return to it in dealing with the results of operations.

c In the so-called *duodenal motility*, *i e*, the initially accelerated and subsequently abnormally retarded voiding of the stomach, we find a diminished 2 hours' residue and an abnormal 6 hours' residue, whereas in pure pylorospasm the stomach also holds an abnormally large content after 2 hours. The distinction of both conditions is easily made by an investigation after 2 hours.

d In toxic pylorospasm (morphine, nicotine, etc.) as a part of the phenomenon of the gastrosplasm recently described by Holzknecht and Lueger in its radiologic point of view.

e In hyperacidity without ulcer.

This short review may show how difficult it is to judge of a purely functional 6 hours' residuum and how careful we must be, even omitting entirely the difficulties of the differential diagnosis in cases of the 6 hours' residue caused by an organic stenosis which we will treat in detail in speaking of the organic stenoses. In summing up we can say that an apparent 6 hours' residue with preserved or even increased peristalsis gives an essential indication but no real proof for the existence of a pyloric ulcer. But we have no way of knowing how often, on the contrary, pyloric ulcers exist without pylorospasm which, therefore, escape entirely our Röntgen examination.

B The Non-stenosed, Penetrating Gastric Ulcer—This group contains especially those ulcers for which the surgical treatment has become of importance within the last years, namely, the old ulcers of the lesser curvature. To avoid misunderstanding, we will first of all briefly describe the action of the penetrating ulcer.

The penetrating ulcer is one which perforates all layers of the gastric

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wall, while the gastric cavity is separated from the abdominal cavity by the substance of the gastrohepatic ligament or by adhesions. For the formation of this ulcer three possibilities are to be considered.

1. The ulcer is situated exactly at the lesser curvature (very seldom at the greater) and gradually corrodes through all layers to the point of attachment of the gastrohepatic ligament. This ligament forms the natural protection against perforation into the abdominal cavity. Through proliferation and thickening of its connective tissue it makes the base of the ulcer continually more compact without the necessary addition of other adhesions.

2. The ulcer comes to the surface at another place. As in every subacute inflammatory process which goes on in the intestinal canal from inside to outside, the serous membrane reacts with the formation of fibrin. Thus arises a circumscribed perigastritis. A real perforation need by no means occur. The formation of fibrin leads to agglutination with adjacent organs, especially with the posterior abdominal wall in the neighborhood of the pancreas, and anteriorly with the liver. When the process is comparatively acute, the omentum greatly assists in thickening the endangered spot and protecting the rest of the abdominal cavity. Into the adhesions thus formed the ulcer burrows deeper and deeper, and at the same time the adhesions extend further and further.

3. There may be formed an acute and greatly circumscribed perforation, sometimes not larger than a pinhead. When this appears in a not overfilled stomach, and the quantity of the escaping liquid is not large, it reacts in the manner described under 2, with formation of fibrin, with the aid of the neighboring serous surfaces and the omentum, the further course is, with or without the formation of an abscess, that already described by us under 2. The size of the abscess is of no concern, for extensive epigastric abscesses can heal up whether by simple resorption or by self-drainage into the stomach as long as the base of the ulcer is adherent to a neighboring organ or, more exactly, formed out of it. The question of the extent to which adhesions may develop will be discussed later. We know especially from appendicitis, to what degree an abdominal cavity entirely obliterated through inflammatory processes may in time be restored.

Our observations made years ago upon the varying extension of the peritoneal processes in encapsuled perforation, led us to conclude that without doubt a part of the so-called penetrating ulcers pursue this course. We must not, however, overlook the significance of the other modes of origin.

Form 2 is really the mildest of all forms of the protected perforation

In this occurs first diapedesis of micro-organisms and then the formation of fibrin upon the serous membrane. Only after the development of adhesions occurs the perfect destruction of the gastric wall at the base of the ulcer. These processes can be observed very distinctly in the different phases of the dilatation ulcers of the colon. We need hardly mention that we have abundant opportunities to see aggregation of fibrin and agglutination about ulcers of the vermiform appendix which are not yet perforated.

For a better understanding we may classify questions of diagnosis as follows

1 *Ulcers at the lesser curvature and its adjoining region* Prior to the time of the Röntgen rays, we were able at best only to guess the existence of ulcers, as long as there was no bleeding. Now the diagnosis, when the technic of the examination is a proper one, should be quite certain. Its particular feature is the *notch* which was first recognized by Haudek in its full importance. Their characteristic signs are (a) the sharply circumscribed protrusion at some point in the lesser curvature, (b) the gas bubble frequently found above the contrast shadow in the erect position, (c) occasionally, the remaining for a longer period of the contrast substance in the notch after evacuation of the stomach.

Although it may be a simple matter to discover the notch in typical cases, nevertheless we must beware of false conclusions. It may easily be overlooked. This is particularly so when the ulcer is situated very near the cardia. Then the gastric filling does not extend high enough, especially not when the examination is made in the erect position, possibly not even in the horizontal position. Provided there is sufficient evidence of an ulcer, the patient must be examined in an oblique position with the upper part of the trunk lying low (Trendelenburg's position) and finally in the right lateral position. Besides this we must also give in such cases a larger quantity of contrast pap than ordinarily, for instance, 600 instead of 400 grammes.

In other cases the symptom may be recognized only indistinctly in consequence of chance insufficient filling of the notch, even if it lies lower down. A new examination, also in right lateral position, with very watery contrast food, often shows it very distinctly.

Sometimes, on the other hand, shadows which have nothing to do with the notch are taken for such. I will not speak of the transverse spinal process shadow, calcified glands and renal calculi which the beginner occasionally confuses with a notch. Doubts arise rather from accidental gastric pouches caused by certain states of contraction, especially by the bulging between two waves of contraction following close

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upon one another. A marked picture of a notch with a covered-over bubble of gas may be mistaken for the duodenal ampulla or stomach cap. If doubt persists, repeated examination, after atropine injection, must be made.

A symptom which greatly facilitates the diagnosis of the notch is the existence of a permanent contraction at the greater curvature at a point corresponding to the notch in question, or even the picture of a cicatrized hour-glass stomach. But it may be said again that we do not always find a spastic constriction of the greater curvature in every case of penetrating ulcer of the lesser curvature.

The striking frequency of ulcers at the lesser curvature in the Rontgen picture suggests the further question, whether all notches appearing in the Rontgen picture at the lesser curvature are really situated there. This question can be easily answered in the negative. Because of the fact, that an ulcer in the neighborhood of the lesser curvature, whether situated on the anterior or posterior surface of the stomach, fastens itself to the posterior abdominal wall, the liver, etc., it becomes, so to say, the fixation point for the stomach and thus replaces the support which the stomach normally has at the gastrohepatic ligament. In consequence of this the latter will be somewhat stretched, and the stomach, influenced by gravity, topples over, according to the location of the ulcer, either toward the front or the back, so that the lesser curvature lies a little to the front or to the back, and the ulcer takes its place. Many ulcers seated apparently at the lesser curvature are in fact merely in that vicinity.

Views of the stomach without contrast meal, with air or gas inflation alone, sometimes give pictures very characteristic of ulcers through the dark band and the hour-glass contraction, but they are not to be generally resorted to, because they cannot replace the contrast view, and because we have to limit ourselves, to save time and expenses, to those views which give us a maximum of information. Besides, the danger of perforation through gas inflation is not inconsiderable.

2 *Ulcers remote from the lesser curvature.* When a penetrating ulcer is so far distant from the lesser curvature that it cannot reach the right boundary line of the stomach shadow, *i.e.*, the place of the lesser curvature when the stomach is toppled over (rotation around its longitudinal axis), it is not demonstrable through the Rontgen picture in the anteroposterior view. But such an ulcer could be shown if, after evacuation of the stomach, a shadow of contrast substance should appear at a circumscribed unchangeable place. This is especially true of the ulcers of the posterior gastric wall. Ulcers of the anterior wall which

are so far away from the lesser curvature that they do not lie within its region are not yet described as taken into the Rontgen photography. They may be so rare that this kind of diagnosis with its difficulties has no practical value. For such ulcers of the anterior and posterior wall remote from the lesser curvature, the profile view of the stomach, proposed by Cole and lately by E. Schlesinger, ought finally to be considered, a matter heretofore too much neglected.

C The Stenosing Gastric Ulcer —Stenosis, as well as a hemorrhage, the results of an ulcer, could be diagnosed without difficulty even prior to the Rontgen period, provided the clinical symptoms of retention were present. But in this case too the Rontgen examination has been an aid, whereas formerly the existence of a stenosis was disclosed by the patient having seizures of marked board-like contraction of the stomach wall, or signs of severe dilatation or even retention vomitus, and when the stomach tube showed food residues of the previous day. We are now able by means of the Rontgen examination to perceive stenoses of a lighter grade without repeated use of the tube, and to determine its exact location. Whereas formerly the majority of the mediogastric stenoses were clinically considered as pyloric stenoses, and only the experienced observers were correct in their diagnosis of "hour-glass stomach," to-day we can recognize both principal forms of ulcerative contraction of stomach by a mere glance at the Rontgen picture. We distinguish

1 *Mediogastric stenosis (hour-glass stomach)* Every one knows that in the beginning of the study of X-rays of the stomach wrong use was made at times of the expression "hour-glass stomach." This term was used for every bipartition of the Rontgen shadow, until it was recognized that the greater part of these bipartitions do not depend upon an anatomical change, but only upon a circumscribed spasm. Extensive experience, however, permits us to set up the following types of bipartition of the gastric shadow.

(a) *The purely spastic hour-glass stomach* This has previously been found in connection with the superficial gastric ulcer, and likewise appears again with the penetrating ulcer.

(b) *The mixed hour-glass stomach* Combination of cicatricial contraction of the stomach with spastic constriction. In these cases the cicatricial contraction is not so pronounced as to substantially interfere with the permeability of the stomach. If such a case should appear, however, it would be caused by the spastic component. In the Rontgen picture this form very much resembles the purely spastic hour-glass stomach,

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and a sure differentiation cannot be made with the Rontgen picture, if the atropine test remains uncertain

(c) *The cicatricial hour-glass stomach* which alone deserves its name in the old sense Here, through further and further contraction of the gastric wall in the region of the ulcer, the lumen is finally narrowed to a minimum The highest forms of the stenosis differ from the spastic hour-glass stomach by the fact that the flow of the contrast pap into the lower gastric section is very much retarded, whereas in the truly spastic hour-glass stomach both gastric sections fill up, one right after the other, and in consequence are filled just after the ingestion of the contrast meal Moreover, where this symptom is not evident, the cicatricial hour-glass stomach differs from the spastic, mostly by the more funnel-shaped constriction, arising not only from the side of the greater curvature, but at times also by the peculiarities and irregularities in its form Finally, a cicatricial hour-glass stomach cannot be influenced by atropine

In comparing the clinical symptoms with the results of the Rontgen examination we find that real phenomena of obstruction of the stomach contents are not met with in spastic and mixed hour-glass constriction, but only in the purely cicatricial type When we are able to take out by siphon method food residues of the previous day, or when we find a remainder of 12 to 24 hours in the upper sac, then the hour-glass stomach is an anatomical one, even if the first Rontgen picture should, by exception, leave us in doubt

Tuberculous changes (Fischer) and luetic gastric ulcers (Holissch) may exceptionally lead to the hour-glass type But these occurrences are so rare that they cannot be regarded as typical results Anamnesis, clinical and serological symptoms will give essential indications, operation alone, however, will reveal the correct facts Later on we will speak of the carcinomatous hour-glass stomach

2 *Ulcer at the pylorus with stenosis.* With the pyloric ulcer the problem is to recognize the stenosis as an anatomical one, not caused by pylorospasm only, and later, if possible, to differentiate the different forms of anatomical stenosis

The occurrence of the following symptoms tends to prove the case to be one of *organic stenosis*

(a) The clinical symptoms Special prominence of pain, irregularity of the attacks, short duration of the signs of retention are characteristic of spasm, but retention existing for a longer time, gradually increasing with uniform troubles, indicates organic narrowing The latter also shows fluctuations just in accordance with the state of com-

compensation of the muscular apparatus of the stomach, but these fluctuations are not the sudden, incalculable ones such as attend pylorospasm, and above all depend less upon the nature of the food that has been introduced

(b) The time relations of the retention One might emphasize here that the Rontgen picture alone does not provide in all cases a clear image of the proportions of retention, and that, as Hurter claims, the result of the clinical locomotion tests ought to be taken into account One fact especially is to be emphasized The contrast pap, whether in normal time or whether somewhat delayed, can be entirely expelled even where larger food particles are retained through mechanical impediment This is true of the common gastric ulcer, but especially so of the carcinoma, in which case the contrast meal often enters the intestine at the normal rate of time, while coarser food particles, for instance residues of prunes, are retained 12 and more hours In one instance of carcinomatous stenosis I observed that more than twelve half figs had been remaining in the stomach for two weeks, while the entire contrast meal entered the intestine, though somewhat retarded In cases of ptosis larger food particles are said to remain in the bottom of the flabby gastric sac (Sahl) By bearing these facts in mind and not neglecting the ordinary motility test we are able to obtain through the Rontgen picture both valuable and, at times, conclusive indications, and be certain of their accuracy

In order to diagnose a mechanical stenosis we must know at what moment the evacuation of the stomach may be prevented by purely functional spastic states To begin with the negative fact must not be overlooked that the evacuation of the contrast meal within 6 hours by no means excludes an organic stenosis The only sign pointing toward a constriction in such cases is the character of the peristaltic movements, when accentuated in a certain time, but especially when deepened As we know, a peristaltic wave normally passes over the stomach every 18 to 21 seconds Thus on one picture at a 5-seconds rate of exposure only one wave can be normally observed But we have often convinced ourselves that even with a normally functioning stomach 2, 3 or exceptionally 4 light peristaltic waves can be found on the same picture Anything exceeding that must make one suspicious of stenosis in some form or of an unregulated activity of the stomach in consequence of an affection of the nervous system (locomotor ataxia) That which proves an impediment and causes one to suspect an *organic* stenosis is the accumulation of waves of great depth

Opposed to the negative fact just mentioned, we are able, in accord-

ance with most of the observers, to regard the following as a positive indication namely, that if half of the contrast meal remains after 6 hours, this proves with certainty a functional or organic impediment, without giving more weight to either side. Only a 6 hours' residue, corresponding nearly to the entire contrast meal, which would point toward a probable 24 hours' time of expulsion, is to be regarded with nearly entire safety as an organic stenosis.

(c) The action of atropine or papaverine on the spasm. Both drugs are said to relieve spasms and actually do so in many cases, so that the diagnosis can often be established by their use. But some observers, for instance Holzkecht, consider this method not beyond reproach, and consequently it is better to be on the lookout for more essential facts.

(d) The water test. As Von Mering first showed, water will pass the pylorus under conditions in which all solid food is held back by a pyloric reflex. Holzkecht and Fujami, following Schwarz and Kaestle, have, therefore, investigated with the aid of partially submerged, partially floating bismuth pills, both in normal circumstances and in existing pylorospasm, the time consumed in expelling 200 grammes of water from the stomach. The average was about 60 minutes, with a fluctuation of 55 to 80 minutes. In cases of organic stenosis, on the contrary, periods of 105 to 115 minutes were found. Should these findings be further confirmed, we would have in the retarded passage of water a reliable test to differentiate an organic stenosis from a functional one.

(e) The shape of the stomach. The shape of the stomach remains, on the whole, normal in cases of purely functional stenoses. An increase in the width of the stomach may, however, be observed in cases of organic pyloric stenosis, so that in the upright patient test residue has a more or less plate-like form, and the pylorus is abnormally dislodged far to the right. A side view shows in cases of beginning stenoses the body of the stomach expanded into the form of a flat cup (Jaubert de Beaujeu), whereas it is usually perceived as a wide diagonal band. The shape of the stomach in chronic dilatation in consequence of organic stenosis in the different positions of the body is mostly so marked, that the experienced investigator establishes the diagnosis at once.

As soon as the diagnosis of an organic stenosis is established, it is worth while to keep separate the two subsequent phenomena of the pyloric ulcer.

Narrowing through rigid inflammatory infiltration of the wall on the one side, and cicatricial stenosis of a healed ulcer on the other are to be distinguished in the following way. Clinically, we sometimes find in the first condition an ulcer tumor, but not in the latter. Furthermore, the first

state appears more acute, *i e.*, in the course of a few weeks or months, while the cicatrix has been long accumulating and is usually the final result of a patient's history dating back several decades. If the unusual finding of a notch picture in the pyloric region does not make a diagnosis possible,—we have never seen it,—we cannot draw any certain conclusions from the Röntgen picture. The following consideration allows, at any rate, a relative inference. The stenosis caused by infiltration of the wall suppresses a proportionally broad section of the pyloric shadow and of the adjacent zone of the pars pylorica, the cicatrix formed, like a diaphragm, suppresses only a small zone. Where the stenosis is not a perfect one, and we can see, under certain circumstances, the bulbous duodenum filled, we will regard a broad zone of suppression between duodenum and gastric shadow as due to a callosity in the wall, and regard a narrow zone of suppression as a pure cicatricial stenosis. Larger hemorrhages are also indicative of an actual ulcer. The suppression of a part of the pars pylorica in the gastric picture is, however, so suspicious of cancer that it will be seldom possible to exclude carcinoma with any probability by means of the Röntgen picture alone. We can be certain the case is cancer, when with such a gastric picture the evacuation is a normal or even an accelerated one. The picture of the cicatricial occlusion of the pylorus may be confounded with that of the shrinking pyloric carcinoma.

D The Non-stenosed Duodenal Ulcer.—A duodenal ulcer is one lying chiefly beyond the pylorus—at most its outer edge may be contiguous with the pylorus, a *pyloric ulcer*, on the other hand, particularly when it is deep rooted, infringes upon the mucous membrane of the pylorus, and even upon the sphincter itself. As far as the functional disturbances themselves are concerned, it is a matter for the individual to decide, whether an ulcer be duodenal or pyloric in its nature. But the designation ought to be such as to present the facts in a purely objective manner. Unequivocal, positive signs of duodenal ulcer are to be had neither in the anamnesis, in the clinical findings, nor in the Röntgen picture. If we accept the symptom, so masterly described by Moynihan, the symptom of the periodical secondary pain after taking of food, often retarded several years, as suggestive of a duodenal ulcer, we must try to establish the positive diagnosis by testing accurately the gastric contents and the feces for blood, since pains of an entirely similar nature are observed without any formation of ulcers. If positive traces of blood are found in both the gastric and intestinal contents, this would be indicative of a gastric ulcer, but when the traces of blood are found only in the intestines, this would indicate an ulcer of the duodenum. Every precau-

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tion must, of course, have been employed to guard against the admixture of blood traces from any other source or from any other cause

Important as is the presence of blood, it is, nevertheless, not decisive, for, as many observers remark, blood is often absent in actual ulcers or is only present intermittently. When no blood is found after repeated examinations, we must seek for another indication of ulcer in the sensitiveness to pressure in the region immediately at the right of the median line.

The first to which we pay attention is the mode of evacuation of the stomach. Moynihan, Barclay, Hertz, Meunier, Holzknecht, Haudek, Kreuzfuchs and others have stated the following as the *type of the gastric evacuation* in duodenal ulcer. At first the stomach empties quicker than normally, so that after 2 to 3 hours the whole or, at least, the largest part of its contents is found in the intestine and descends then comparatively quickly. Toward the end the emptying often retards, so that, on the other hand, contrary to the normal process, a 6 hours' residue often remains. Despite this 6 hours' residue, the contrast filling in the colon is said to have pushed forward abnormally far, as far as the plexura linealis, according to Jonas. The abnormally quick emptying is explained in the sense of a reflex insufficiency of the pylorus, and, in fact, we find in the Röntgen picture and on the screen the pylorus abnormally open. The 6 hours' residuum, by no means regular, is referred by Kreuzfuchs to a retarded pylorospasm. We cannot here enter upon the details of the various theories that have been advanced with reference to this peculiar disturbance of the intestinal motility. Further observations have shown, on the one hand, that this duodenal motility is by no means found in all cases of duodenal ulcer and, on the other hand, that it is observed in other very different affections of the duodenal region. Thus it is found according to Bergmann in hyperacidity without ulcer. Again, we find it in the early stage of carcinoma of the body of the stomach. Finally, it is seen just in those diseases which compete with the duodenal ulcer in differential diagnosis, namely, in diseases of the pancreas and the gall-bladder. The duodenal motility is, therefore, but a sign awakening suspicion, not a pathognomonic symptom.

To recognize it, we must either observe the patient during a longer time at the screen at the beginning of the emptying of the stomach or, what is more simple and sufficient for practice, make an X-ray examination 2 hours afterwards, as is always done in a case where a duodenal disease is suspected. If, after that time, the most of the stomach contents, perhaps even the entire contents, are in the intestine, we may regard this as an accelerated evacuation.

Interesting as a rare isolated observation, but for the present without demonstrable internal connection, is the appearance of *spastic hour-glass stomach* with duodenal ulcer. Inasmuch as control by an autopsy is not available, the existence of a small superficial ulcer of the stomach cannot be excluded, because it can easily be overlooked during the operation, especially as its presence need not appear at the outer surface of the stomach. Therefore this symptom has as yet no diagnostic value.

A peculiarity, if functional, brought on by the evacuation of the stomach, if organic, by the bending of the duodenum, is the existence of a shadow in the bulbus duodeni, the stomach cap, as it is very significantly called by Cole. This latter is regarded as in some degree characteristic for duodenal ulcer. But its presence is so frequent an occurrence that I would not lay the least stress upon it, unless it shows a nicely round form or one that is running to a point like a hood. It is another thing if it shows itself in the same way distorted at different views. Then we would have the right to presume if not a duodenal ulcer, at least inflammatory adhesions of some kind in the duodenal region. They could be due just as well to an old cholecystitis as to an inflammatory process in the duodenum itself. As a control in the differential diagnosis of such adhesions the examination in the right lateral position, as already mentioned, is to be recommended.

The persisting duodenal shadow is of far greater significance. The remaining of contrast substance in the duodenum at a circumscribed place, after complete evacuation of the stomach and the upper small intestine, has from the beginning been considered as a sign suspicious of a duodenal ulcer. In fact, it may be a case of contrast substance remaining in a notch situated behind the duodenum. Likewise it could be regarded as one of those congenital diverticula described by Wilkie and others, and finally, as I myself have observed, such duodenal spots are also found at pouch formations through adhesions between the duodenum and neighboring organs, the liver or the gall-bladder. But these adhesions are not necessarily connected with a duodenal ulcer, yet may be caused by a cholecystitis. Thus the persisting duodenal shadow is important as awakening suspicion, but is by no means a certain sign, that an ulcer still exists.

More proof of the existence of an ulcer is given by the notch, *i. e.*, a shadowy prominence projected beyond the duodenal shadow, if positively demonstrated by repeated observations. But this notch is so extremely rare at the duodenum, that it has, as Haudek admits himself, no great practical value for the diagnosis. Besides mistakes are here more easily possible than with notches of the stomach, and Haudek

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himself emphasizes that above the bulbus shadow there is often a gas bubble which may give rise to an erroneous conception that this is due to a notch. He adds that he never observed a gas bubble at the notch spot of a penetrating duodenal ulcer.

Furthermore it is to be noted, that the duodenum, with respect to the entire pyloric region, can be shifted very little. This sign, too, is but a relative one, since the diminution of the facility with which the duodenum may be shifted, may originate as well in an extraduodenal inflammatory process or in a malignant neoplasm, as in a duodenal ulcer. At any rate its proof is of importance in so far as it shows us, at least, that in the duodenal region an inflammatory process is still existing or terminated. The demonstration of this fixation is still deficient, as we will see in a special chapter.

All the points have now been considered which may be utilized for purposes of diagnosis in the case of duodenal ulcer. The conditions of the stomach secretions should, for the sake of completeness, be examined in each case, but we cannot draw any diagnostic conclusions from the findings, because, as all observers agree, in regard to the reaction of hydrochloric acid as well as to the motility, the most marked changes may be produced by a slight sickness, and even so irregularly, that the predominance of the anomaly or the other—increase or decrease of the free hydrochloric acid—seems to be a matter of chance.

Whether the experiments of Einhorn in obtaining a blood spot from the duodenum by the thread test, or to procure some of its contents by aspiration through a tube or finally to obtain a full destruction of it with contrast substance by means of a duodenal obturator, will aid in the diagnosis of the duodenal ulcer, only time will tell. Positive proofs are, as far as I know, still lacking.

With reference to the diagnosis of duodenal ulcer and especially the significance of examination by the Röntgen rays, the following summarizes the situation:

When the anamnesis and the clinical conditions indicate the probability of an ulcer or prove it directly by hemorrhages, we conclude by the negative findings in the stomach, that the ulcer is very likely situated in the duodenum. Diagnosis of a gastric ulcer is usually a positive one, that of the duodenal ulcer a diagnosis *per exclusionem*. It consists on the positive side of a number of symptoms, some of which are of themselves proof, and which are important only because of their relation to one another.

E The Stenosed Duodenal Ulcer.—We can readily separate the stenosed from the non-stenosed ulcers in diagnostics, because we are

now on secure ground. The chyme normally passes the duodenum so quickly and in such small quantities that we never get in the Röntgen picture a complete filling out or even a somewhat complete outline of this part of the intestine. If we find it densely filled with contrast substance so that we can clearly follow its course in its entire extent or, at least, to a certain point, we must conclude that there is an obstruction further down. Concerning the nature of this obstruction the Röntgen picture is of no avail. I have known such duodenal filling to be caused by the compression of tuberculous glands and by pericholecystic inflammatory processes. We may regard the stenosis as an ulcer only when another cause is lacking, and when the anamnesis itself indicates duodenal ulcer. These restrictions are necessary, also because stenosis is a very rare occurrence with duodenal ulcer. Under certain circumstances we will recognize, as Bier describes it, the cone-shaped filling of the constricted lumen in the Röntgen picture. The significance of fruitless peristaltic waves above the stenosis is referred to by Holzknecht. It is remarkable that it needs a considerable constriction in order to bring out such demonstration of filling of the duodenal section above the stenosis, and that the stomach shows very late decided symptoms of regurgitation. The dilution of the contrast meal, already mixed with gastric juice, by bile and pancreatic juice, explains this sufficiently.

It may be mentioned in passing, that theoretically the filling out of the duodenum with contrast substance must also arise in cases of arteriomesenteric intestinal occlusion, particularly when there is a decided bend of the duodenum as it becomes jejunum. But the fact that in reality such a stasis is rarely observed, shows, as Moynihan correctly remarks, that Lane and Jordan go a great deal too far in their diagnosis, and that their conception is not justified by the Röntgen picture.

II How can adhesions be recognized?

Closely connected with diagnostics of ulcers are those of adhesions. The clinical examination of these leaves us entirely at sea, and if we establish the diagnosis of "adhesions" on the ground of clinical symptoms exhibited by the stomach—as well as anywhere else in the abdominal cavity,—we must always be aware that we are expressing a mere guess.

Abnormal adhesions involving the stomach can be anticipated from the following three conditions

1. An abnormal position of the pylorus, the stomach being but normally filled

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2 The too slight displacement of the pylorus upon examination in different positions of the body.

3 From anomalies of the stomach not otherwise explained.

1. *Abnormal position of the pylorus* means either unusually remote distance from the median line to the right (right distance) or, on the contrary, a situation on the left side of the vertebral column or an abnormally low position. The normal pylorus is normally situated about on the line of the right transverse vertebral processes. A decided dislocation to the right suggests adhesions only when it is not caused by an abnormal state of fulness of the stomach (retention) or by temporary rigid contraction of its wall (gastrospasm). Also when it can be taken as the result of an adhesion provided the pylorus does not descend when the patient's position is changed.

Usually the pylorus moves somewhat toward the median line when the stomach is emptied. Its situation left of the median line is in all probability caused by adhesions. This certainly does not point toward ulcerative adhesions, but, as experience shows, toward carcinomatous fixation.

From abnormal descent itself we can conclude *a priori* only upon increased motility. Fixed descent is very rare. For the sake of completeness it may be mentioned, that the whole stomach may be displaced in any direction in the widest sense by large abdominal tumors. The form of displacement of the stomach is usually in a sickle-shaped (falciform) or ligament-like distortion of such a nature that no doubt may rise.

2 *To test the displacement* of the pylorus we compare the pictures of the examinations in upright and horizontal positions. Normally we find a movability of the pylorus to the extent of 2 to 3 vertebræ (7 to 10 cm). Fixation through adhesion may be supposed when the displacement, upon the change of position with the same gastric content, is a good deal less than this. Most reliable will be the diagnosis of pyloric adhesion, if we can prove both abnormal situation and faulty displacement. Even then we do not know whether the interference with the displacement is not due to a disease of neighboring organs (gall-bladder and pancreas). The inspection of the Röntgen pictures shows, in conformity with the findings at operations, that the displacement of the pylorus itself, while the ulcerative processes are active, depends very essentially upon that of the entire abdominal viscera.

3 One is inclined to infer the presence of adhesions from gastric and duodenal change of form, otherwise inexplicable. This conclusion is justified in the cicatricial hour-glass stomach, with which there is always

an abnormal fixation at least to the gastrohepatic ligament and generally at each pronounced notch. Also in the region of hour-glass sténoses and notches we often find in the stomach picture either protrusions running to a point or, on the other hand, constrictions which distinguish themselves at the first sight from the more roundish constrictions or protrusions of the peristaltic waves, the constancy of which at different takings permits the certain diagnosis of constricting adhesions. At the greater curvature such adhesions are rarer, but irregularities in the marginal outline in consequence of the contiguity of the transverse and descending colon are very frequent. To infer adhesions from irregular form of the greater curvature is only permitted, when the change of form persists at each taking, even after evacuation of the colon, and when it cannot be explained by displacing tumors situated without the stomach. Finally, it must be recalled that sometimes very marked cicatricial bands cause no changes of form of the stomach.

Of special importance is the diagnosis of adhesions in the region of the duodenum. By their presence, as we have already seen, the duodenal spot is sometimes to be explained, which remains after entire evacuation. By adhesion the duodenal wall is drawn out like a pouch and in this the contrast substance remains for some time. But this pouch formed by adhesion cannot be distinguished from a congenital pouch or an ulcerative notch. With greater certainty we can establish the diagnosis of adhesion, if the filling of the bulbus duodeni, the so-called gastric cap shows an irregular form. Most frequently it presents itself normally as a pointed cap with nicely caudate edges, less frequently as a roundish formation with smooth edges. But if we find the same anomaly of form at the same place after several sittings, we may decide for adhesions with some probability.

The more carefully we control the diagnosis at the operation, the more we receive the impression that even now *in X-ray work*, as formerly was the case *in clinical observation*, adhesions are diagnosed too often.

III How can we recognize or exclude the carcinomatous degeneration of a gastric ulcer?

It is not in the intent of this report to consider the differential diagnosis between gastric ulcer and carcinoma to its full extent. Consequently we limit ourselves to the question, whether and how far the Röntgen picture permits us to recognize, in the presence of symptoms of ulcer, whether or not the disease had already changed into carcinoma. The answer to this question has less importance than the further ques-

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tion, not *whether*, but *how* it is to be operated, and what will be the prognosis of the interference

It may appear simpler, since an operation must be done at any rate, to leave the decision of the question, whether it is a simple ulcer or carcinoma, to the operator. But the experienced surgeon knows, that the examination of the open abdomen does not always permit a decision, and that he is frequently happy to possess, also, clinical findings accurately taken and a good Rontgen picture as a foundation of his diagnosis and his therapeutic decision.

It may be permitted, without going into detail of the problem, to insert some observations concerning the *subsequent carcinomatous degeneration of the simple ulcer*. If we are to discuss the radiological signs of such a degeneration, we must first know whether it exists at all. This carcinomatous degeneration of an originally simple gastric ulcer, affirmed without any trace of proof in various even pathologico-anatomical researches, is emphatically denied by Duplant on the ground of careful investigations in a study much too little known. Between these two extremes there are those newer studies which try to assign a certain percentage between benign callous and cancerous gastric ulcer, especially on the ground of clinical material gained through operation for the pathologico-anatomical investigation. Such examinations are of no small importance for establishing an indication at the open abdomen. The numbers gained by this method are so contradictory that they can be utilized only with great care.

To know the frequency with which a simple ulcer becomes a carcinoma in its further development, we must renounce, because we will never know, how many gastric and duodenal ulcers remain clinically latent and are not even found at autopsies. Just as little will we be able to ascertain, how many carcinomata originated from an ulcer, since the ulcer may have remained latent in a single case, and since the carcinoma is often so far developed at the time when it causes clinical symptoms, that its origin *ex ulcere* is entirely effaced by the carcinomatous destruction of the tissues. Finally, primary carcinomata may afterward assume, by ulcerative disintegration, as Duplant says, certain features of a primary ulcer or at least of what we call a "*carcinoma ex ulcere*." We will be able to establish only, how many cases showing the appearances of a pure ulcer in their history and clinical symptoms, and also presenting the signs of a simple callous ulcer at operation, have proved themselves to be carcinomata by their further development and the histological investigation, and on the other hand, how many of the carcinomata examined histologically point toward an original ulcer through

their anamnesis and through their pathologico-anatomical signs, for instance, the course of the muscularis

That a carcinoma may develop from a simple ulcer, be it callous or not, is made probable through the general experiences of the pathology of tumors. That this change really occurs, is positively proved by clinical observation and histological examination. But we cannot make any certain conception as to the frequency of this occurrence. The most reliable data must be obtained from the further observation of patients subjected to gastro-enterostomy, because here the diagnosis of ulcer was not only clinically established, but also confirmed through the findings of the operation. If we take into consideration that here the development of carcinoma is observed only in 2 per cent of all cases from a very large series of figures, we may at least conclude that the carcinomatous degeneration of a round gastric ulcer is of relatively rare occurrence. The possibility that the gastro-enterostomy has operated against the development of carcinoma, could have been adjusted statistically by the fact, that, on the other hand, among the cases considered as simple ulcers at operation there could be primary carcinomata histologically found at the time of operation, and that not all gastric carcinomata originated *after* a simple ulcer did so *because* of it.

It is important, as soon as there is suspicion of cancer, to search for metastases. Strauss, in view of the difficulty of the differential diagnosis which we are occupied with, refers to the importance of the metastases in Douglas' pouch demonstrable from the rectum, which he found in about one-tenth of all cases of his patients with gastric carcinoma. Schnitzler, Bensaude, and Boas also call attention to the diagnostic and prognostic importance of these metastases.

The chief progress of the last years in the differential diagnosis between simple and carcinomatous ulcer lies in the *Röntgen examination*. But even this, indeed, does not always give the desired decision, and we must too frequently leave the question open even after having taken the Röntgen picture into consideration.

To begin with the *ulcer of the central part of the stomach*. The characteristic feature of the penetrating ulcer is the notch, thus causing a plus of shadow, the characteristic of the carcinoma is the erosion, thus causing a minus of shadow. But, indeed, it happens that the central crater of a carcinoma, decayed through ulcerous degeneration, presents itself as a notch, and *vice versa* that of an ulcer penetrating a notch in carcinomatous degeneration of secondary masses of a tumor which protrude into the stomach and which have undergone erosion. In either case we may believe that a pure notch is presented to us. But

if we imagine the boundary line of the lesser curvature continued on both sides to the region of the notch, we may ascertain in general, whether along with the formation of a notch there also exists a real erosion of a proliferated mass of tumors into the gastric lumen. Especially is the decision easy when the erosion in the gastric shadow around the notch appears irregularly bounded or knobby or like digital impressions. But there are cases with which belong the observations communicated by Holitsch which have a doubtful interpretation. In a single case it may be very doubtful, how to imagine the contour lines of the lesser curvature continued beyond the notch.

More difficult still is the judgment of *stenoses of the pylorus*. Typical for pure ulcerative stenosis is smooth closure of the shadow at the pylorus joined to an unusual situation of the pylorus to the right, in consequence of the dilatation of the stomach,—the latter dependent upon the longer period of development of the stenoses of the ulcers. Where this smooth closure is present with nicely caudate marginal outline and where the stomach contents do not extend cone-shaped into the strictured region, there we can justly suppose a benign ulcerative cicatrix, and there it is entirely impossible, relying alone on the Röntgen picture, to differentiate the ulcerative stenosis from certain small, shrinking, slowly growing carcinomata. More often we find with the pyloric carcinoma a somewhat irregular boundary of the gastric shadow, the enclosing of a piece of the antrum pylori into the stenosis, marked left situation of the whole stomach as contrasted with the pronounced right situation, nearly regular, of the ulcerative stenosis, small displacement of the pylorus in changing the position (according to our observations on the average over the space of but one vertebra), so that in the majority of cases the experienced observer is not in doubt. Whether the carcinoma is a primary one or a secondary implantation upon a pyloric ulcer, does not play any rôle for the differential diagnosis between ulcer and carcinoma.

Essentially more difficult is the Röntgen diagnosis of the duodenal carcinoma, whether it be growing upon an ulcer or not—a question which shall probably always be an open one. The cases of duodenal carcinoma which I have observed within the last years, could not be positively diagnosed with the aid of the Röntgen picture. Ordinarily we obtain merely indirect signs which point toward this diagnosis, especially those of occlusion of the ductus choledochus and of the duct of Wirsung. We will always think of carcinoma, if we find an abnormal duodenal filling with irregular boundary in the Röntgen picture, the clinical signs of which do not date very far back.

IV. What conclusions may be derived from the examination technique of the present day as to the indication for operation and to the choice of the method of operation?

1 If manifest or occult hemorrhages are lacking, the Röntgen picture is entirely normal, and there are but subjective complaints, *i.e.*, pains, the degree and the character of the latter will determine our decision. If the pain takes the character of that connected with an ulcer, it will essentially depend upon its intensity and the disturbance of nutrition and vocation caused by the former, and also upon the success of internal therapy, whether or not we propose operation to the patient. It will be first of all an explorative one. But from the beginning we will, above all, focus attention upon the duodenum, because experience shows that with complaints of ulcer of longer duration and higher degree, while the gastric picture is nevertheless normal, the ulcer is very seldom situated in the stomach.

2 If the Röntgen findings are negative, if there is no clinical retention, but if the diagnosis of "ulcer" results from manifest or occult hemorrhages, the indication for operation after the failure of internal therapy is a more decided one. Here, too, the lack of changes in the gastric image points to the duodenum. What the method of operation in such cases shall be,—only gastro-enterostomy or closure of the pylorus in any form,—the examination cannot decide, that depends only and solely upon the conception and experience of the operating surgeon and the general condition of the patient.

3 If we find in the Röntgen picture the signs of retention followed by pyloric stenosis, operation is indicated. The larger the residue in the stomach is and the longer it remains there, the more urgent the operation. Thus, as we have already seen, a small residue after 6 hours proves nothing. In case of a large residue after 6 hours but which evacuates within the first 12 hours, the indication is not very strong. But it is so if there is a residue after 24 hours, although there are patients who are able by special skill in feeding to keep themselves at a fairly good equilibrium for a long time with such a stenosis. But this is accompanied with such inconveniences, that the operation is indicated under any circumstances from the physician's stand-point.

These rules apply to the organic pyloric stenosis caused by cicatrization. Provided we may assume merely a spasm, we will concede a first place to the internal treatment, and even when a reason prevails to operate for the impediment in inflammatory infiltration of the wall, all phenomena of retention may disappear under internal treatment,—to be permanent in most cases not permanently.

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The indication for operation is naturally the same, whether the impediment is caused by a mediogastric stenosis, a pyloric constriction or by the cicatrization of a duodenal ulcer. Only the interference will be an entirely different one. At the mediogastric stenosis we will, if possible, remove the impediment by a transverse resection, or unite the upper sac with the lower one or with the jejunum. At the pyloric constriction we will, as a rule, be satisfied with the gastro-enterostomy, and at the duodenal stenosis we have to decide according to the prevailing circumstances, whether we will undertake the simple gastro-enterostomy, or the one-sided disconnection of the duodenum, or even its resection.

4 If the Rontgen examination shows us the clear picture of a penetrating ulcer in the region of the lesser curvature, the indication for operation must depend upon the judgment of the surgeon. Which operation is to be chosen, gastro-enterostomy alone, or excision of the ulcer or transverse resection,—does not depend upon the Rontgen picture, but upon the attitude of the surgeon toward the question of resection. Only in one direction may the Rontgen picture point the way when Haudek's notch is very wide, we must conclude, that the operative interference will be a very extensive and difficult one. In cases of a large notch, even when we are, on the whole, believers in excision of the ulcer or of the transverse resection, we must, from the beginning, proceed cautiously if the patient gives us the impression of inability to stand severe interference, or if his subjective complaints would not justify a severe interference not entirely without danger. Finally, an ulcer situated high up on the lesser curvature lends itself less to excision, but gives, on the other hand, success after gastro-enterostomy, than a notch ulcer situated nearer the pylorus.

5 A positive condition within the duodenum—duodenal spot, abnormal form of the cap, unusual filling and abnormal form and direction in the course, and abnormally small displacement of the other part of the duodenum—gives us in connection with clinical symptoms, a more or less decided indication for operation and, at the same time, points to the nature of the interference. The choice is here, too, not caused by the examination findings, but by the attitude and experience of the surgeon.

V What advantages do Rontgen diagnostics offer for judgment as to the immediate and subsequent results of operation?

In recent years we have become more confident on matters relating to the surgery of the stomach and intestine, not the least because we are able to judge and control more safely than previously the consequences to the patient *after* operation, and because we are therefore able to

remove eventual disorders and follow our aim more consistently than formerly

A The Immediate Effects of Operation—Although severe derangements of the evacuation of the stomach in cases of simple gastro-enterostomies have now become rare, owing to progress in technic, they have not entirely disappeared even in benign affections of the stomach. Ptosis, motor insufficiency of the stomach (very rare), old adhesions may even now originate after interferences which have been apparently correctly executed. We must be particularly cautious, when there are complicated conditions in consequence of former operations which have been followed by a new ulcer ventriculi or an ulcer pepticum jejuni. When a gastro-enterostomy will not suffice, the question confronting the surgeon will be a double one: *Shall* another operation be performed, and if so, *how* shall it be done?

In reply to the first question, the Röntgen examination usually gives the correct answer. Provided nothing has passed out of the stomach after 6 hours, the need of an interference is very great, and provided the closure remained intact after 12 hours, in spite of change of the patient's position (especially right side, even knee-elbow position) an operation must be made.

When, on the contrary, we find the intestine already partially filled after this period in spite of a large gastric residue, we may comfortably wait, for the impediment will probably be removed by itself.

But especially important is the explanation which the Röntgen picture affords relative to the seat of the impediment. When not only the stomach, but also the upper duodenal peduncle is filled, we are concerned with a regular vicious circle which will be remedied by Braun's anastomosis. But when the two loop peduncles applied to the stomach are empty, the anastomosis is of no value, and it must be cared for in a manner so that the newly created opening, between the stomach and the intestine, functions, or that in evading the existing one a new gastro-enterostomy is applied, for example, by means of a far-reaching Y. Elsewhere I observed a case in which the omission of the Röntgen control led the operating surgeon to an incorrect and unsuccessful after-operation. This case clearly showed what little reliance can be placed upon the supposition, that we can normally judge the conditions at the after-operation and select the right interference. The Röntgen picture usually permits a much more reliable judgment of the function than the "immediate glance," so often disturbed by adhesions.

The Röntgen picture gives also trustworthy explanation with refer-

ence to the operative effects at the excisions of ulcers and at the transverse resections

As I have already shown in 1911, circumscribed spasms in the region of the suture line may appear long after the operation itself, which spasms may be dispelled by atropine. These usually do not impair the gastric functions. Since then we have further observed the continuous spasm in the region of suture lines involving the stomach, as, for instance, in a case of papillomatous polyp of the mucous membrane, for which the excision of the gastric wall involved only the mucous membrane and the submucosa, whereas the muscular layer was sewed without resection. Stierlin has, on the other hand, shown, based upon our clinical experiences, that the pylorospasm disappears after the transverse resection, which we so frequently observe in ulcers of the lesser curvature. Following immediately upon the operation of transverse resection, obstructions in the *upper* part of the stomach may arise, which are to be referred not only to the local spasm, but probably to a light, post-operative infiltration of the gastric wall in the region of the suture, and to a preceding kinking of the surface. I saw a disturbance of the gastric evacuation for the first two weeks which was very unfavorable, but which proved, upon repeated Rontgen examinations, not to be complete, so that we could wait patiently. The function of the stomach which had been subjected to a transverse resection was restored to a normal condition. Our observations as to transverse resection of the stomach are now affirmed by Kummell, and especially so in regard to the light spastic congestion above the suture, and in regard to the unusually rapid evacuation of the lower section of the stomach, described by Stierlin. Kummell, too, found that the entire function of the stomach is not at all impaired by the light congestion above the suture line, and that, on the contrary, the evacuation of the stomach occurs quicker than under normal conditions, an observation which Kuster could, however, not verify. This brings us to the final results upon an operated stomach.

B The Diagnostic Criticism of the Ultimate Disturbances and Final Results—It is very valuable to be able to control the further development of our gastro-intestinal operation with the aid of the Rontgen examination. Let us begin with the functional disorders.

Mikulicz has already emphasized the fact, that after a gastro-enterostomy, successful from the very outset, a favorable course does not always follow, and that in some cases the result may be complicated more or less by pronounced late disturbances, and this statement has been reiterated in the past years by Clairmont, Deaver, Dénéchau and

others Every operating surgeon who pays attention to these things in his later examinations will be able to report such cases In this way it is of especial value to be capable, with the aid of the Rontgen picture, to perceive, at least to a certain degree, upon what the late disturbances depend We may best divide them in accordance with our experience in two groups

1 *Late disturbances without interruption in the progress of food, i e*, with evacuation of the stomach within the first 4 to, at most, 6 hours with normal peristalsis Here there is no mechanical impediment, for even with good compensation such would manifest itself through abnormally deep peristaltic waves The disturbances depend either on the continuance of the old ulcer or on the formation of a new one in the stomach or jejunum, or at last they belong to the favored chapter of adhesion pains behind which there is too often simply a delicate nervous system

The continuance or new formation of an ulcer can sometimes be seen in the Rontgen picture without further investigation Thus, I found a well developed ulcer notch explaining the severe complaints of a woman formerly subjected to gastro-enterostomy by another surgeon, because of an ulcer A new interference showed that there really existed a penetrating ulcer It might very readily have been of later origin, for in its region, near the lesser curvature, 3 other scars of old ulcers were found The ulcer was extirpated, as the circumstances did not indicate a transverse resection The complaints lessened considerably without entirely disappearing A re-examination, 1½ years subsequently, again showed the existence of a small notch In other cases, especially where the duodenum is involved, the Rontgen picture renders no aid, and we learn of the continuance of the ulcer only through the pains and the re-occurrence of hemorrhages In two cases of *ulcus duodeni* treated by other surgeons by inturning and in which the motility was normal according to the Rontgen picture, I had to resort to the one-sided disconnection of the pylorus, when the troubles continued with renewed hemorrhages

In cases of secondary disorders as well as in consequence of peptic ulcers of the jejunum the Rontgen picture affords no criteria We can make the diagnosis as a conjecture only from the intensity of the complaints, and from the fact that there had been an anterior gastro-enterostomy with long jejunal leg

As to the disturbances due to adhesions, it is conceivable that adhesions between stomach or jejunum and anterior abdominal wall will lead to complaints, even when the passing of food is not immediately

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disturbed Adhesions of this kind could possibly be detected in a profile view Much more frequently the adhesions do not involve the abdominal wall, but are limited to the region of the actual site of operation, *i e*, the gastro-intestinal sutures, and here they will not, we believe, lead to grave complaints with normal individuals Usually it is more the nervous system that is to be suspected A man twenty years old, the diagnosis in whose case was stenosed pyloric and duodenal ulcer, had undergone somewhere else an operation of gastro-enterostomy He now asserts that his complaints remain the same or even increased The Rontgen picture shows that along with the well functioning gastro-enterostomy there is also a fully functioning pylorus, therefore no stenosed ulcer Blood in the fæces not to be found, in spite of repeated examinations Evacuation of the stomach is entirely normal In consequence of his intense complaints, preventing, as he stated, every professional work, and at his urgent request, an inspection of the abdomen is made The result is, absolutely normal conditions existing in the region of the gastro-enterostomy, a normal pylorus and normal duodenum with no sign of an ulcer still present, and without the least trace of cicatrization or thickening, pylorus normally permeable, no adhesions between stomach or intestine and anterior abdominal wall The course of healing is normal in every particular, and his complaints disappear The question immediately arises did both the pyloric and duodenal ulcers, which were found at the first operation, disappear without scars or was the surgeon who in the first instance performed the operation, mislead by the well known white spot—the appearance of a particle of the muscular layer during a spastic contraction—or by a pylorospasm present during the operation? We will not decide the question But the case is instructive and shows the importance of the secondary complaints in cases of gastro-enterostomy

Such secondary complaints by a patient may be attributed to cases in which an ulcer benign at first, develops into a carcinomatous one, or in cases where carcinoma, overlooked at the first operation, continues to develop In such cases, too, the Rontgen picture gives no definite aid in the beginning In time, however, a defect in the filling will occur which cannot be explained by the mere existence of a gastro-enterostomy

2 *Late Disturbances Accompanied with a Retardation in the Passing of Food*—Such late disturbances may be due to different causes

Cases in which the gastro-enterostomy was done at an unsuitable place, or, as was formerly the custom, cases in which it was made too

small, yet could, to be sure, function for some time and facilitate the healing of the ulcer. Along with this the pylorus would again function, and the artificial gastro-intestinal opening would necessarily contract. In case a second pylorospasm sets in in consequence of a new ulcer, the gastro-enterostomy no longer suffices, and the result is a more or less pronounced degree of retention, a 6 hours' residue, etc

Where the original operation was not gastro-enterostomy, but excision or transverse resection, at which an abounding fortifying of the suture by means of the omentum was done, this omental cord along the suture may cause the development of a gastric constriction gradually tightening with positive retardation of passage of the food. On one occasion I observed this after elliptic resection, and on another after an abounding fortifying of the suture of an acutely perforated ulcer of the lesser curvature. In both cases the omental cord was responsible for the signs of retention which appeared several months later. The Rontgen picture showed the gastric shadow sharply cut at the height of the cord.

3 Especially important is the after-examination with X-rays in making the comparative judgment of the different principles and methods of operation. The different methods of gastro-enterostomy may be examined, as Hartmann particularly did, with regard to their function and the lack of secondary complaints. Furthermore, the methods of resection may be compared, particularly the elliptic excisions and the transverse resection for the ulcer at the lesser curvature. Then the results of the excision of ulcer for the ulcers of the lesser curvature may be compared with the results of the mere gastro-enterostomy. In a similar way for the duodenal ulcer, the results of the mere gastro-enterostomy ought to be compared with those of the simultaneous pyloric disconnection and, finally, the different methods of disconnection should be comparatively studied.

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THE COURSE OF ACQUIRED DISEASE OF THE THYROID GLAND AND THE PRINCIPLES WHICH SEEM TO CONTROL ITS PROGRESS *

BY JOHN ROGERS, M.D

OF NEW YORK

THE acquired diseases of the thyroid gland are usually enumerated as (1) goitre, with the subclasses of simple, solid, cystic or colloid, (2) cancer, (3) exophthalmic goitre, and (4) myxœdema. In addition, but only within the last few years, some recognition has been accorded to functional disorders. Cancer of the thyroid will not be discussed here, as it does not differ from cancer of other important glands. It has occurred in my experience in the proportion of about one in two hundred and seventy-five cases of demonstrable thyroid disease, and has always run a rapidly fatal course.

All other acquired diseases of the thyroid seem closely related in origin. Each seems to begin in the same way, but sooner or later to follow a different direction which terminates in one of the typical diseases of the gland or in one of the complications with which thyroid abnormalities are so often associated. There seem to be recognizable stages in this progress, and these stages are apparently accompanied by sufficiently definite and constant circumstances or conditions to explain at least the general nature of the pathological physiology which may become manifest.

The natural course of events, in which there is an evident beginning, an intermediate period and a termination of thyroid disease, is much confused for several reasons. In the first place, the initial symptoms are extremely vague and common to many physiological conditions, and only become abnormal or pathological when long continued or exceptionally pronounced. Next, the different stages in functional thyroid

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diseases show great variations in duration and severity, indeed, thyroid disease seems capable of becoming stationary at any stage, or of alternating between one stage and the next for an indefinite period, or of showing more than one stage at the same time, and almost innumerable complications may at any time arise and either conceal the thyroid disturbance or supersede it in importance, or finally, thyroid disease may apparently be a complication of some pre-existing malady. Nevertheless, by comparing one condition with another, and by careful observation of cases which subsequently develop into the typical diseases, it is possible to trace what seems to be the natural or regular progress of events when complications do not obscure it.

The Nature or Regular Course of Thyroid Disease—Simple Goitre—Goitre is generally described apart from the functional diseases of the thyroid, and as though it were not subject to variations in the activity of the secreting epithelium. But even a small amount of experience will show that practically every "simple" goitre, at one time or another, and occasionally for long periods, may be accompanied by signs ordinarily accepted as those indicating either under- or over-activity of the epithelium. There are only a few exceptional instances of Graves' disease which do not present thyroid enlargement or goitre from the beginning to the end, and there are so many examples of otherwise typical myxoedema in subjects who have presented for years a so-called simple goitre that an increase in size of the gland seems the regular or natural first stage in all the acquired thyroid diseases. No matter what the subsequent developments may be, the enlargement regularly begins with a multiplication of all the glandular elements and is thus technically a simple hypertrophy. This may slowly disappear or persist indefinitely as a harmless disfigurement, or it may undergo the changes in outline and consistence which indicate the development of a colloid, cystic, adenomatous or fibrous goitre. These degenerative processes may, of course, begin so early that the regularly preceding stage of simple hypertrophy is not apparent, although it can always be assumed to have existed.

The gross alterations in the structure of the gland may take place gradually and without noticeable constitutional disturbances, or they may increase rapidly or more perceptibly at some periods than at others. But contrary to the usual belief, all rapid changes in the outline or consistence of the gland while developing, are accompanied by at least some of the signs of hypothyroidism, or less often by those of hyperthyroidism. Moreover, any of these so-called simple or supposedly symptomless goitres, even after they have existed for years in a quiescent

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condition, may give rise to the severest forms of any of the functional thyroid diseases

CASE I—*Simple goitre of young women* Miss J F, age eighteen, was first seen January 2, 1908 She had become alarmed at the appearance of what her physician called a "goitre" Tall, poor muscular development, thin neck and enlargement of the thyroid to about triple the normal size Skin pallid No complaints except lassitude, weakness, anorexia, some constipation, and wakefulness rather than insomnia Pulse 72, respiration 18, temperature 98°, blood-pressure 105, hæmoglobin 90 per cent Urine negative, menstruation regular though scanty, no discoverable abnormality other than the thyroid enlargement which in outline and consistence was that of a simple hypertrophy There was a history of rapid growth at the age of sixteen, followed by the usual entrance into strenuous social activities of the well-to-do, with late hours and insufficient sleep Advised a hygienic and simple life, with nine hours sleep each night and a small amount of thyroid feeding to "help out" the supposedly fatigued thyroid

May 16, 1910 Thyroid enlargement has disappeared No discoverable abnormality

February 26, 1912 Returns with a history of several months of strenuous social activity and complains of fatigue after the least exertion, and a small cyst about one inch in diameter in the right lobe of an otherwise imperceptible thyroid This was discovered a few days previously after a night at a ball No other abnormalities Advised rest and hygiene and thyroid feeding as before

March 15, 1913 Cyst smaller and softer, and apparently in process of disappearance General health excellent

CASE II—*Simple goitre followed by exophthalmic goitre* Miss E S, age fifty-three, first noted a goitre about 35 years ago after a year of hard study and too little sleep This was at first soft and symmetrical, but gradually became firmer and more uneven in outline About six years ago, after the death of her parents and much financial anxiety, she began to be nervous and have palpitation This was cured by rest and some medication administered in drops (potassium iodide?), but she remained weak A year ago she was forced to move from her former home and soon afterward noted recurrence of the tremulousness and cardiac distress She was unable to rest, and some weeks later detected a peculiar stare in the eyes

She was first seen in November, 1909, and presented the signs of mild but typical exophthalmic goitre with a large thyroid containing many cysts and much fibrous tissue The exophthalmos

was slight Pulse 110-120 Blood-pressure 140 to 150 She was given antithyroid serum for several weeks, and at the end of 6 months recovered completely, except that the goitre remained unchanged

In June, 1913, the goitre had slightly increased in size The pulse was 80 and irregular, though there appeared to be no gross lesion of the heart The blood-pressure varied from 160 to 180 There was no consciousness of any illness or disability

Myxœdema and Hypothyroidism—These terms should not be used as though synonymous

The usual text-book description of myxœdema is of a chronic disease of middle life or later, which begins insidiously with atrophy and not with hypertrophy of the thyroid But it cannot be disputed that the disorder frequently occurs in persons who have possessed a more or less quiescent goitre for months or years, and that after death the characteristic changes in the thyroid vesicles are the same in the goitrous and the atrophied glands The only difference is in the amount of functionless structure The so-called typical or idiopathic myxœdema which begins after middle life with a primary atrophy of the thyroid is a rare disease in my experience, while the myxœdematoid conditions which develop in long-standing goitres are very common and symptomatically the same There is one noteworthy difference, however, the myxœdema which occurs with goitre is generally much more easily relieved than the disease which is accompanied by no thyroid enlargement Indeed, typical myxœdema, or that which follows primary atrophy of the gland, seems to be a very serious if not an irremediable condition It is not the easily cured disease ordinarily described Myxœdema and conditions designated as myxœdematoid begin gradually and at any age, but are much more common after than before middle life, and in women rather than men, and these conditions are encountered more often with than without goitre Like other thyroid diseases the earlier it appears the worse seems to be the prognosis It cannot be disputed that its gradual onset is through a stage of hypothyroidism, the symptoms of which show an increasing severity

Myxœdema, or a condition indistinguishable from it, thus seems to begin in the majority of cases or in its regular form with the simple hypertrophy, which constitutes the first regular stage in all thyroid disease The intermediate or next stage is that of hypothyroidism, which terminates in the typical and fully developed disease The rarer or less common form begins without the first stage, that

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is, in an absence of the usual primary hypertrophy, but shows the usual incipient or hypothyroid symptoms of the second stage, and seems to involve a worse prognosis than when it begins with goitre. The most common and serious complication is a nephritis, and it is more frequent when the myxœdema is secondary to goitre and not atrophy of the thyroid.

If recovery takes place, it is through a stage in which there is decreasing evidence of hypothyroidism and the usual "goitre" disappears last.

CASE III — *Simple goitre followed by myxœdema*. Miss N. T., age twenty-two, is an adopted child of unknown parentage. Dysmenorrhœa from the beginning at thirteen years. At twenty, after a period of much study and worry, suffered from insomnia, anorexia, constipation, general asthenia, and noted thyroid enlargement (stages of hypertrophy and hypothyroidism). During this period menstruation became scanty and irregular. The following summer and winter, while living in the country under favorable hygienic conditions, the usual vigorous health returned, though the thyroid remained enlarged but felt soft. In the fall of 1912, after resuming strenuous social activities, she began to note an increasing weakness and considerable gain in flesh and some diminution in the size of the thyroid.

She was first seen February 12, 1913. Apparently well-nourished. Color ivory white, with slight puffiness about the eyelids and marked œdema of the ankles. Thyroid enlarged to twice the normal size, but feels dense and firm. Pulse 60, respiration 18, temperature 97.6° F, blood-pressure 90, hæmoglobin 90 per cent, urine negative. No other objective abnormalities. Complaints of weakness, mental inertia, drowsiness, constipation which can only be relieved by drastic cathartics. Inordinate appetite. Had been taking thyroid in doses of 1 grain of the commercial tablet three or four times a day with relief. A tentative doubling of the dose caused palpitation and trembling without any appreciable gain. After some experimentation it was found that a combination of a 1 grain thyroid tablet and a 1 grain capsule of desiccated suprarenal powder given after meals relieved all the symptoms.

March 21, 1913. The thyroid has become almost imperceptible and is soft instead of hard. Pulse 86 instead of 60 or below. Blood-pressure 110. In the past week there has been a loss of three pounds, and the bowels move naturally and regularly. The œdema has disappeared.

August 2, 1913. This marked improvement did not continue, and the patient seems slowly losing ground.

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CASE V—*Simple hyperthyroidism* Miss L. C., age twenty-eight Her occupation as lady's maid compelled her to pass the years of 1906 and 1907 with only a few hours sleep nightly and constant care of clothes during the day In December, 1907, after an attack of grippe, her physician noted the goitre In January, 1908, she was weak and tired, and had early morning wakefulness In May, 1908, headaches, insomnia, anorexia and constipation, or signs of hypothyroidism, appeared Two competent observers said that at that time there was no tachycardia In June, she noticed dyspnoea on exertion, palpitation of the heart and trembling In July the headache had disappeared, but the goitre had become larger and the other signs of hyperthyroidism were unmistakable There was no exophthalmos She then had a pulse of 120-140, with the vasomotor and nervous phenomena characteristic of her condition There was a considerable goitre much larger on the right than the left side

August 4, 1908 Under ether, at St Francis Hospital, I excised the right or larger lobe and the isthmus There followed a severe reaction which subsided in the course of a week, and in September, 1908, she left the hospital apparently well but still weak and with a perceptible left lobe of the thyroid, and on my advice went to her home in Sweden for eight months In June, 1909, she returned in apparently perfect health and resumed work as a children's governess

In November, 1911, appears with a dry cough, pulse 90-100, blood-pressure 110, some insomnia, constipation and weakness These symptoms followed much fatigue in the course of her duties as a governess A two weeks' vacation, with a little thyroid feeding, was followed by a complete restoration to the normal (stage of mixed hypo- and hyperthyroidism)

In January, 1913, a similar disturbance was relieved in the same way This illustrates the course of an apparently perfect cure of hyperthyroidism by partial thyroidectomy

Many cases remain for an indefinite period in the third or hyperthyroid stage, and these often show alterations in symptoms, sometimes those of excessive activity of the gland predominate, and again those of deficient functionation If recovery is to take place, however, the evidences of hyperthyroidism gradually grow less and usually occur at longer intervals, during which the symptoms of hypothyroidism are more or less distinct, and may not cease until the goitre or last symptom disappears

On the other hand, death may occur at any time after the beginning of the third or hyperthyroid stage, but it is much less common in this

CASE IV — *The so-called primary myxœdema of advanced life*
 Mrs M C, age fifty-four, had always been surrounded with every comfort, and had never been exposed to any strenuous experience. She was first seen in March, 1907, and presented the typical appearance. She gave a history of gradual development of weakness and inability to withstand ordinary mental or physical exertion, or extremes of heat or cold. This had begun seven or eight years previously, soon after the menopause of which the asthenia was supposed to be symptomatic. There had, however, been much anxiety at this period over some family matters. There were at first remissions of the weakness coincident with rest and unusually good hygiene (stage of hypothyroidism). Tonics and the best of environment and consultations failed to cause improvement until Dr M A Starr finally recognized the condition and began thyroid feeding, $\frac{1}{4}$ grain (commercial) thyroid taken once daily produced a marked gain, but the dosage could not be increased without exciting signs of hyperthyroidism. In 1912 the œdema of the eyelids and ankles, and mental and physical asthenia began to reappear, and could not be held in check by the usual thyroid preparations, and a laboratory product supposed to contain only active thyroid proteins was tried. This succeeded much better, and the subjective symptoms were still held in check by this preparation, but the dosage has had to be gradually increased of late, and the ivory white color is not satisfactory, it is impossible to expect that feeding any artificial product can permanently take the place of an organ which seems to be atrophying.

Exophthalmic Goitre and Hyperthyroidism — These terms should not be used as though they were synonymous.

Exophthalmic goitre, like myxœdema, seems to be the terminal stage of a chronic process which begins with simple hypertrophy of the thyroid. Protrusion of the eyes is the last to appear of the three cardinal symptoms, namely, tachycardia, tremor and exophthalmos, which formerly were considered necessary to establish a diagnosis. With the exception of retro-ocular tumors or aneurisms, the only known cause of exophthalmos is the condition of hyperthyroidism. The goitre is the first sign in so large a majority of cases, and is so often accomplished during its inception by more or less evidence of hypothyroidism that enlargement of the gland, with at least traces of deficiency in its functional activity, must be regarded as the regular first and second stages of what may later prove to be typical Graves' disease. The third stage, which may entirely hide the second, is marked by the characteristic rapidity of the pulse and the nervous irritability, which are generally accepted as the chief evidences of hyperthyroidism.

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These were apparently periods of alternating hypo- and hyperthyroidism. In 1906, there was considerable pigmentation, a dry skin. No exophthalmos, but a peculiar puffiness about the eyelids. A small, firm goitre. Pulse 100 to 110. Blood-pressure 150 to 160. In 1907 the only change was a slight increase in blood-pressure to 160 or 170. Urine negative. In April, 1908, a partial thyroidectomy was performed in Europe, with some relief of the nervousness and tachycardia, but without improvement in the strength. In June, 1908, the blood-pressure was 180. Urine negative. In January, 1909, there were still slight evidences of hyperthyroidism and the blood-pressure about the same, but the urine showed casts and traces of albumen. The blood-pressure varied between 200 and 230. There was no exophthalmos. During the following six months there was a gradual loss of strength and uræmia finally developed and after a few days terminated fatally.

Though regularly produced by hyperthyroidism, exophthalmos is not by any means a constant result of it. In my experience it is encountered in not more than 25 per cent of the total number of individuals who give signs generally accepted as those indicating a greater than normal activity of the gland. Hence the necessity of the term hyperthyroidism, as ordinarily used it seems to imply an incipient condition which may result in one of a more serious nature. Exophthalmos appears after and not before the other symptoms, and when it occurs marks the incidence of the fourth stage, or that of typical exophthalmic goitre.

The fourth stage of the disease, or that of the typical Graves' disease, is marked by a gradual and generally intermittent development of its distinguishing symptom. After its appearance the hope of recovery is distinctly less than before, and the probabilities of the development of complications is greatly increased. If the exophthalmos is only moderate and of recent development, a restoration to a completely normal state may take place. But the more pronounced the symptom and the longer it has existed the less is this hope.

If recovery is to follow, the exophthalmos only subsides first when it has been slight or intermittent or of recent occurrence, next, there is the same retrogression through the stage of hyperthyroidism and the mixed stage of hyper- and hypothyroidism. Then follows a gradual predominance of hypothyroidism and possibly some enlargement and softening of the goitre, until after months or years this last symptom or goitre, disappears. More frequently, at least some traces of the exophthalmos persist and even outlast all other signs, including the enlargement of the thyroid. But if this abnormality persists long

than the fourth stage or that of exophthalmic goitre. The fatal end may come rapidly from an acute intensification of all the symptoms, or gradually and after years with increasing signs of myxœdema. But the immediate cause of death is then more frequently from one of the complications which occur with a rising blood-pressure. For the third stage, or that of chronic hyperthyroidism, if of long duration, sooner or later shows an increase in arterial tension, and this is accompanied by cardiac and nephritic and other degenerative lesions.

CASE VI—*Acute toxæmic thyroidism following simple goitre*
Miss M. R., age eighteen, was a school athlete and great basket ball player. After the first year of these activities, at the age of 17, a small soft goitre was noted. She played tennis during the next summer without discomfort and with much energy, but tired easily, was constipated, and had many headaches (hypothyroidism). In the fall she entered college and attempted gymnasium athletics, but was forced to stop because of the constantly rapid heart action. At this time the headaches ceased and the constipation disappeared, and she was "nervous" and some insomnia (stage of hyperthyroidism).

After rest, enforced by these conditions in November, 1905, the pulse slowly came down to 100 or 110, and she considered herself well, but seemed to have a constant slight hyperthyroidism and a small "goitre."

On May 4, 1906, she attended a class banquet and the following day developed an acute gastro-enteritis. On May 5, the pulse began to show an alarming increase in rapidity, reaching 200 or more to the minute. There was severe headache, extreme restlessness and a temperature of 101° to 102°. The goitre was dense and of small size, and there was marked pulsation in the cervical vessels. The headache deepened into stupor. The temperature increased, and death followed without the appearance of any exophthalmos.

CASE VII—*Chronic hyperthyroidism and death from nephritis*
J. G., age fifty-six. He had worked at his business as a banker very hard and for many years with no vacation. During 1899 he had many headaches and was easily fatigued (hypothyroidism). He then took a month's rest, but after resuming work began to be troubled with breathlessness and palpitation, and a small goitre was detected. He was then treated for Graves' disease, though there was no exophthalmos. During the next six years there were periods of headache, constipation, pallor and asthenia after resting, which alternated with nervousness, palpitation, dyspnoea and insomnia after times of business activity.

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August 25 Considerable reaction followed these slight operations, but it gradually subsided

October, 1912 Pulse 110-120 Exophthalmos somewhat improved Goitre soft Blood-pressure 120. Complains only of weakness, of growing fat, has gained 15 pounds

May, 1913 Pulse still irritable, but when patient is at rest pulse is 80 to 90 Exophthalmos only perceptible after exertion

October, 1913 No trace of any abnormality except a slightly enlarged left thyroid lobe

As in the previous stage, death may occur at any time and acutely in this fourth period, with an intensification of all symptoms or slowly after the elapse of years Under the latter conditions there is almost invariably a gradual rise in the arterial tension With it there regularly occur degenerative lesions of the heart which supersede the regular signs of hyperthyroidism until these become unrecognizable Then place is taken by a myxœdematoid state, or one of hypothyroidism, and all that remains to recall or suggest the original difficulty is the exophthalmos Though this termination is manifestly not typical exophthalmic goitre, it is the regular terminal, or fifth stage, of the process which passes through the four preceding stages

CASE IX — *Termination of chronic exophthalmic goitre* Mrs A F, age fifty-two, was said to have developed exophthalmic goitre about fifteen years ago She was first seen in November, 1907 There was very pronounced exophthalmos, an ivory-white pallor, much œdema about the legs, a moderate-sized, hard goitre of uneven outline, enormously dilated cervical veins and very marked pulsation in the cervical vessels Heart dilated, many abnormal sounds, apex in the anterior axillary line Pulse extremely irregular and varying between 60 and 150 Blood-pressure (systolic) 180-220 Urine contains a large amount of albumin and casts This patient for the past six months had shown considerable mental deterioration, and required the constant care of two nurses The mentality rapidly failed, and death took place apparently from uræmia, in January, 1908

The disease rarely takes another form and develops without any appreciable enlargement of the thyroid The stage of goitre and hypothyroidism does not occur, and that of hyperthyroidism appears to develop rapidly or even suddenly, and may or may not be accompanied by more or less pronounced exophthalmos This course of events is exceptional, but when it takes place without enlargement of the thyroid, or with but slight enlargement and that after the appear-

enough there will almost certainly follow a rising blood-pressure and its attendant dangers. A glycosuria may appear, and is a dangerous complication. A psychosis has occurred often enough among my cases to receive mention as a not infrequent complication, especially of the fourth stage.

CASE VIII — *Simple goitre, hypothyroidism, hyperthyroidism, exophthalmic goitre*. Mrs H. H., age twenty-eight, has always been nervous and has suffered from childhood with frequent headaches and bilious attacks. During the latter months of her first and only pregnancy six years ago she apparently had some toxæmia with albuminuria, but bore her child without accident at full term. In 1909, this child had anterior poliomyelitis and the mother took charge of her alone night and day, and suffered great fatigue and anxiety for many months. When the child began to recover, in December, 1910, a goitre was noted in the mother, who complained of weariness, constipation and much headache (hypothyroidism). In February, 1911, the mother had another period of anxiety, and the goitre enlarged and palpitation and dyspnœa on exertion became troublesome. About this time the headaches subsided and insomnia was more or less constant.

May 11, 1911. Typical hyperthyroidism. Large firm goitre, tremor. Moist and flushed skin. No exophthalmos. Pulse 120 to 130. Blood-pressure 130. The treatment consisted of a few injections of antithyroid serum, and a carefully regulated and hygienic mode of life.

May, 1912. Apparently a perfect cure with the exception of a small soft goitre.

June, 1912, was passed in very strenuous social experiences with dancing and late hours.

July 2, 1912. Appears again with typical hyperthyroidism, no exophthalmos. Antithyroid serum tried, but no benefit followed.

July 15, 1912. During the past two weeks her child had been ill, and again caused her much anxiety and now exophthalmos is distinct after exertion or excitement. While quiet in bed it is not apparent.

July 25, 1912. The condition seems worse. Pulse 130-140. Goitre firmer. Expansile pulsation in cervical vessels and exophthalmos seems constant and more pronounced.

July 31, 1912. Novocaine-adrenalin anæsthesia. Right superior thyroid vessels tied and cut, and tip of right lobe excised. Left inferior artery ligated and not cut.

August 7. Novocaine-adrenalin anæsthesia. Left superior vessels cut and tip of left lobe excised. Right inferior artery ligated.

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Irregular Functional Diseases—The irregular types of thyroid disease can, for the most part, be classified in two groups. In the first, and probably most numerous group, one or more of the usual symptoms, especially the goitre, are lacking, while the nervous and cardiac irritability are present constantly, or at frequent or irregular intervals. The difficulties in diagnosis are often considerable, and the relative importance of the thyroid in the disturbance may be a matter of opinion. Under these conditions it should be recalled that a perceptible enlargement of the gland is of great assistance in identifying thyroid symptoms, for it must be conceded that any gland in which the isthmus or a portion of a lobe is perceptible to sight or touch, is larger than normal and so has undergone simple hypertrophy. The next stage in functional thyroid disorders should regularly be manifested by signs of hypothyroidism, and the next succeeding this may be either myxœdema or hyperthyroidism, and then exophthalmic goitre. It must also be recalled that either hyperthyroidism or exophthalmic goitre, if they continue long enough, may terminate in a condition which is essentially that of myxœdema, or if hyperthyroidism shows a tendency to retrogress and improve, it passes through a stage in which signs of hypo- and hyperthyroidism alternate. When these facts are borne in mind it becomes possible to identify many obscure cases.

This group in which the goitre is absent or an inconspicuous symptom, as stated previously, seems to have a worse prognosis than the regular group in which enlargement of the gland is marked.

The second, and less numerous group, generally presents an unmistakable goitre or thyroid enlargement, but the other symptoms are not from organs regularly and prominently involved in either hypo- or hyperthyroid conditions. The most noticeable abnormalities pertain to the central nervous system, and are manifested in headaches, or nervous irritability, or a psychosis, or a mental and physical asthenia out of proportion to the state of apparently good nutrition. Less often there are pronounced valvular lesions in the heart, or occasionally there is an unexplainable constipation or diarrhœa. The symptoms and the results of treatment in this second group suggest that the more or less slight evidences of thyroid disease are the result and not the cause of the more prominent difficulties. But where thyroid symptoms can be detected their course is through the stages which mark the regular progress of events in either hypo- or hyperthyroid conditions.

In addition to these two groups of irregular disturbances in which the thyroid seems to participate symptomatically, there is sometimes described a third group under the designation of "dysthyroidism." In

ance of the other symptoms, the disease is generally of unusual severity, as is the case with acute toxæmic thyroidism, and it is exceptionally difficult to relieve by methods which are successful with hyperthyroidism in the presence of goitre. In other words, a condition in which there is great enlargement of the gland and signs of its excessive activity seems less to be feared than a similar condition with little or no enlargement of the gland, and the same is true of the typical myxœdema in which no perceptible goitre has occurred.

All the acquired diseases of the thyroid with the exception of cancer, thus seem to begin with a simple hypertrophy which is apparently physiological and not pathological and is accompanied by more or less distinct signs of hypothyroidism. If thyroid disease is to follow, it advances from this point to the different forms of simple goitre or through intensification of the signs of hypothyroidism with a decrease or increase in the size of the "goitre" into myxœdema, or through a more or less rapid change of the signs of hypothyroidism into those of hyperthyroidism to which the symptom of exophthalmos finally, in the more severe cases, may be added. If exophthalmic goitre lasts long enough, a myxœdematoid state follows. Any simple goitre which has existed, perhaps for years without the accompaniment of disturbances in other organs, may give rise to hypo- or hyperthyroid symptoms and develop into myxœdema or exophthalmic goitre.

Recovery from hyperthyroid conditions may take place from any stage except the last, or fifth, stage, and the prognosis seems better in the presence of goitre than when this symptom is absent. The prognosis is much worse after the development of exophthalmos than before, as over 84 per cent of the deaths in hyperthyroid conditions in my experience have occurred in cases which have presented this symptom, and the more pronounced it is the worse is the outlook both as regards disabling complications and the duration of life.

If recovery takes place, it is gradual and through a retracement of the steps which mark the advance in the disease. Restoration to health after the development of hyperthyroidism always passes through a period in which hypothyroid symptoms alternate with those of hyperthyroidism until they gradually supersede and entirely displace the latter. After the development of exophthalmic goitre this course toward recovery through an alternating hypo- and hyperthyroidism, is often marked by the persistence of the exophthalmos, even after the goitre and every other abnormal sign has subsided. With this exception, the enlargement of the gland is the last of all the signs of thyroid disease to disappear.

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skin, nervous irritability and a peculiar asthenia which is similar to that of hypothyroidism. In both hypo- and hyperthyroid conditions there is a mental and physical inability to withstand ordinary fatigue, which is possibly the most constant sign of all thyroid disease.

As indicated in the outline of the course of these maladies, there is a considerable difference in their early and late manifestations.

EARLY STAGES OF

HYPOTHYROIDISM

- 1 Goitre of any size but soft
- 2 More common in women during transition periods of life

Skin

- 1 Pallid and dry
- 2 Loss and dryness of hair
- 3 Finger nails brittle
- 4 Subcutaneous fat abundant, increasing

Alimentary Tract

- 1 Mouth dry
- 2 Tongue pale or coated
- 3 Anorexia
- 4 Intestinal fermentation
- 5 Constipation

Circulatory System

- 1 Normal pulse rate
- 2 Blood-pressure 110-115 mm Hg
- 3 Blood count normal
- 4 Slight anæmia
- 5 Temperature slightly subnormal

Respiratory Tract

- 1 Respiratory rate less than 20 per minute

Nervous System

- 1 Incapable of sustained effort
- 2 Some headache
- 3 Insomnia after 2 or 3 A.M.
- 4 No tremor

HYPERTHYROIDISM

- 1 Goitre firmer
- 2 The same

Skin

- 1 Moist and flushed
- 2 Hair fine and oily
- 3 Normal
- 4 Normal or decreasing

Alimentary Tract

- 1 Abundant saliva and mucus
- 2 Normal
- 3 Appetite excessive
- 4 Digestion good
- 5 Bowels move more than once daily

Circulatory System

- 1 Accelerated
- 2 From 120-130
- 3 Inconclusive but may be lymphocytosis
- 4 Hæmoglobin normal
- 5 Slightly above normal

Respiratory Tract

- 1 From 20-24

Nervous System

- 1 Overactive and excitable
- 2 None
- 3 Insomnia before 2 or 3 A.M.
- 4 Tremor present

my opinion, this term should be restricted to cases which present an obvious enlargement of the gland limited to some particular portion of the organ, and who complain of headache or other symptoms not directly traceable to the thyroid and constant or intermittent disturbances having some of the characteristics of either hypo- or hyperthyroidism. If in these cases the complaints can be relieved or cured by extirpation of the diseased area in the thyroid, it is fair to assume that the abnormal tissue gave origin to some peculiar substance which differed from the normal thyroid product and so caused the symptoms. The localized disease seems to act like a retention cyst which occasionally allows its pathological contents to leak into the circulation. I have seen a few cases of this kind in which intermittent or remittent headache was the predominant complaint, and after removal of the cyst or tumor from the thyroid the pain has been sometimes, but not always, or not permanently, cured. Three other cases in which symptoms like those of paroxysmal tachycardia were the most distressing, seem to have been more or less completely relieved by excision of the cystic or adenomatous area in the thyroid together with simultaneous ligation of its two superior vessels.

Symptoms of Hypo- and Hyperthyroidism —As the most important or "regular" directions in which thyroid disease seems to advance or recede are marked by signs of hypo- or hyperthyroidism, it is useful to review these in contrasting columns. Each has been learned from observations upon its terminal stages or myxœdema and exophthalmic goitre, and this knowledge has been gradually supplemented by experiences with thyroid feeding. In the interpretation of symptoms, however, the results of thyroid feeding must be accepted with caution, because if the evidently honest reports which are abundant in literature are to be believed, there is almost no symptom or condition which has not been relieved by this means.

It is generally agreed that evidences of hypothyroidism are to be found in dryness and pallor of the skin and hair and often some loss of hair, in a marked and otherwise unexplainable asthenia, in some headache and defective functionation of the brain and gastro-intestinal tract, in a blood-pressure below 120 mm of mercury, in a subnormal temperature and slowly decreasing activity of the heart and respiration.

The signs of hyperthyroidism are mostly those of excessive activity in the sympathetic nervous system. It is now believed that any degree of constant tachycardia not otherwise explainable is the most reliable evidence of more than the normal activity of the thyroid. The accessory and confirmatory symptoms which are accepted are a moist

This outline of what appears to be the regular or natural course of thyroid disease is useful for prognosis. If the little which is known of the physiology of the gland is compared with the progress of events and their attendant circumstances and conditions, it is possible to trace what appears to be the cause of the abnormalities and to understand at least the general nature of the resultant disturbances. Reasonable therapeutics can then be planned.

The Physiology of the Thyroid —During recent years very few new facts have been added to the little which is known of the physiology of the thyroid. Its function is generally conceded to be confined to the production of its secretion. Several substances all containing iodine have been isolated from the gland, and all seem capable of producing some effect when administered to animals. But no single ingredient has been identified as the active principle of the secretion. In brief, there is no reasonable doubt that the biochemistry of the thyroid epithelium combines iodine with some organic material into a product which is a necessity in the biochemistry of growth and development in general, and of the genital organs in particular, especially those of the female, also, that the thyroid secretion is an important participant in the biochemistry underlying the activities of the central nervous system, the heart, liver and probably the gastro-intestinal tract and respiratory organs. There is every reason to believe that the thyroid product has some quantitative relationship to the activity of all these organs, and that the activity of the thyroid varies in amount according to the needs of any organ or group of organs. These needs must be expressed to the thyroid through the sympathetic or only demonstrable nerve supply of the gland, or through hormones circulating in the blood, or both.

As the most apparent action of the thyroid lies in its stimulation of metabolism, or in the increase of chemical processes which have the effect of increasing nutrition, it is possible for the present to classify the thyroid as an organ concerned chiefly in the production and expenditure of energy, or more briefly as an organ of nutrition. This designation serves at least as a partial answer to the queries presented by the therapeutic problems when the gland is diseased. It also helps to explain the adjective "nervous," which is constantly used to indicate some of the most striking characteristics of patients afflicted with thyroid abnormalities. As ordinarily employed, the adjective "nervous" qualifies a personality or central nervous system which is more than usually sensitive to environment, and hence one which responds to all external and internal stimuli with more than the usual

Genito-Urinary System

- 1 Sexually apathetic
- 2 Urine pale and specific gravity below 1020
- 3 Musculature normal but incapable of sustained activity in all functional thyroid disease

Genito-Urinary System

- 1 Excitable
- 2 High colored and above 1020
- 3 Muscular reflexes exaggerated

LATER STAGES OF

HYPOTHYROIDISM

- 1 Goitre small and firm or absent
- 2 Incidence same as in early stages

HYPERTHYROIDISM

- 1 Goitre of any size
- 2 Same

Skin

- 1 Pallor, ivory white, dry and thick, flush on malar prominences, œdema of ankles
- 2 Hair dry and scanty
- 3 Puffiness of eyelids

Skin

- 1 Pigmented and moist only after exertion or excitement
- 2 Hair fine and moist
- 3 Exophthalmos in about 25 per cent of cases

Alimentary Tract

- 1 Mouth dry
- 2 Tongue pale or coated
- 3 Marked anorexia, intestinal fermentation, constipation
- 4 None

Alimentary Tract

- 1 Slight salivation
- 2 Tongue normal
- 3 Excessive appetite, normal digestion, bowels loose
- 4 Thirst marked

Circulatory System

- 1 Slow pulse
- 2 Blood-pressure below 110
- 3 Blood shows some anæmia
- 4 Temperature 96° to 97°

Circulatory System

- 1 Tachycardia
- 2 Above 130
- 3 Some lymphocytosis
- 4 Above 98.5° to 100° or more

Respiratory Tract

- 1 Respiratory rate below 18
- 2 Some cough, which may be very pronounced

Respiratory Tract

- 1 Above 22
- 2 None

Nervous System

- 1 Mentally dull and apathetic
- 2 Much headache
- 3 Insomnia variable
- 4 The musculature shows an increasing inability to withstand fatigue

Nervous System

- 1 Excitable and unstable
- 2 None
- 3 Insomnia constantly
- 4 Muscles show increased reflexes, atrophy common in the interossei of the hand

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in the third nerve Exophthalmos was once thought to be due to excitation of the superior cervical ganglion of the sympathetic, but the evidence at present seems in favor of its production by retro-ocular œdema The abundance of the oral secretions, sometimes amounting almost to salivation, is traceable to glandular activation through the seventh nerve Dryness of the mouth and pharynx, which may cause an otherwise unexplainable cough, is sometimes present in hypothyroid conditions and may be due to a paresis of the glossopharyngeal I have recently seen one case of irregular hyperthyroidism with a painful soft hypertrophy of the circumvallate papillæ, and it seems explainable through some undue activation by the ninth nerve Some cases of hyperthyroidism show an increased tonus or activity in the tenth nerve, and others the opposite condition I once observed a case of typical severe exophthalmic goitre in which the tachycardia, after the administration of a few drops of potassium iodide solution, rapidly changed to a bradycardia with great exaggeration of the precordial impulse The pulse rate altered within twenty-four hours from 140 to 70, and the following day had dropped to 40 After this rate had persisted a short time, the patient suddenly died No autopsy was permitted It appeared like an exaggeration of the normal tenth nerve effect

The visceral nerves seem to convey opposing influences in different fibres, and practically all of the symptoms of functional thyroid disease can be traced to inhibition or excitation of the different organs by these impulses If each of the ductless glands activates or inhibits some particular group of nerve fibres, at least a part of the relationship and interdependence of these organs becomes apparent

Some recent experiments of Gudernatsch¹ demonstrate most conclusively the interdependence of the thymus and thyroid, and the necessity of the thyroid in developmental processes By feeding thyroid to tadpoles he has thus been able to change the creature almost immediately into the fully developed frog But by withholding thyroid and feeding thymus the metamorphosis is entirely prevented That the thyroid must be active during the metamorphosis of childhood into adolescence and maturity seems thus proved

THE APPARENT CAUSE OF THYROID ABNORMALITIES

An abnormality of the thyroid means a simple hypertrophy of the gland, or the later solid or cystic degenerations which may take place, or any condition of hypo- or hyperthyroidism When these ab-

¹ *Clin Journ Anat*, January, 1914

rapidity and thus requires the production and expenditure of more than the normal average amount of energy. If the thyroid, as seems true, can be classified with the organs of nutrition, it must be more or less constantly active to maintain a "nervous" person in health.

The association of iodine with the physiological activity manifested by the different substances which can be isolated from the gland is striking. The effects produced by the administration of any of these bodies seem roughly to vary in direct proportion to their iodine content. In conditions of hyperthyroidism, however, it is well known that the amount of iodine per gramme of gland substance is less than the normal amount, and the smaller this proportion the more severe as a general rule are the clinical symptoms. I have recently aided in demonstrating that electrical stimulation of the nerve supply of the gland produces a loss of iodine which increases with the duration and amount of the stimulation. In man, the only demonstrable nerve supply of the gland is a filament which arises from the superior cervical ganglion of the sympathetic, and follows approximately the course of the superior thyroid vessels and enters the gland near them. Sympathetic filaments also enter the gland in the walls of the arteries, and can be found around each alveolus.

Some of the more recent experiments are generally accepted as confirming the interdependence chiefly of the thyroid, pancreas and adrenal-sympathetic or chromaffin system, and clinical observation for the most part has added to these the pituitary and thymus. The thyroid and the adrenals seem capable of mutual stimulation or activation, and both give evidence of some inhibition upon the pancreas. The pancreas in turn seems to inhibit the activity of the other two glands. The thymus also seems to present some inhibitory effect upon the chromaffin system. The frequent association of the pituitary, as in acromegaly, with goitre is apparent. The latest theory of disorders referable to these ductless glands revives in part the earlier conceptions of a primary neurosis of the sympathetic system, and includes the cranial and visceropelvic autonomic nerves. These constitute the visceral nervous system, and the parts arising from the medulla are the third, seventh, ninth, tenth and eleventh cranial nerves which are often involved in cases of thyroid disease. Von Graef's sign, or the retraction of the lids, manifested by inability of the upper to follow the lower lid in closing the eye, Stellwag's sign, or the "staring" eyes, and Moebius' sign, or inability to converge the axes of the eyes, and the contracted or dilated pupil, the lachrymation and the not infrequent ptosis are all referable to an increased or decreased "tonus"

or cells of the chromaffin system participate and affect the biochemical activities of the thyroid epithelium

If fatigue is the ultimate or primary cause of all thyroid abnormalities, as seems probable, it then becomes possible to understand these disorders. When thyroid abnormalities appear in childhood their origin can be traced to the need of thyroid secretion to provide for rapid growth and development, especially if the brain is at the same time actively functioning. If one occur in a "shopgirl" or school teacher or trained nurse, it is presumably the result of excessive expenditure of energy by many organs, already taxed to their limit for maintaining the nutritional and metamorphic processes of young womanhood. Pregnancy, infectious diseases, traumatisms and many other conditions or circumstances may thus originate or intensify thyroid disease. Endemic goitre need not be excepted, if only it can be regarded as beginning with a primary hypertrophy to compensate for excessive or unusual demands for thyroid secretion on the part of the liver or digestive tract or some other organ which must be active to dispose of the ingested bacterial or colloidal poison apparently proved to be its ultimate cause.

Surgical Problems of Hypothyroidism—These arise in practically every case of goitre. The symmetrically enlarged soft glands typified in the "simple goitre of young women" are usually regarded as presenting no indications for operation. There is a general belief that the hypertrophy is to compensate for some demand of unknown source for an increased amount of secretion, and that excision of half the organ cannot benefit and may damage the apparently normal processes. If, in spite of rest, the goitre enlarges, ligation of the two superior vessels should be preferred to excision. Localized cysts or tumors are a different matter. If they show no tendency to enlarge and produce no symptoms, the operative indications are merely cosmetic. If they are multiple their excision may involve the sacrifice of enough normal tissue to interfere more or less seriously with the functional capacity of the gland. Should, however, any localized cyst or tumor show a tendency to enlarge its removal is proper, if only because of its pressure upon the surrounding normal thyroid epithelium and its consequent interference with function. Pressure upon adjoining important structures is generally accepted as a positive indication for operation.

The relationship of localized enlargement of the thyroid to the symptoms, sometimes described as those of dysthyroidism, has been referred to previously. These symptoms, if subjective only, may or may not be relieved by removal of the tissue which is supposed to

normalities advance from a less to a more severe stage, as described previously, there is always active functionation of one or more organs which are known to be in some degree dependent upon the thyroid. If there is more than the usual amount of activity in the nervous and vascular systems, or in the liver, or organs of the digestive or genital tracts, any preexisting thyroid abnormality is regularly intensified, and when these activities abate or cease there is regularly a corresponding relief of the thyroid symptoms. This means that conditions or circumstances which require active metabolism and a considerable production and expenditure of energy intensify all thyroid abnormalities. That they cause these abnormalities to begin in only a comparatively few individuals seems due to variations in the vital capacity of different thyroids, or to the variable amounts of energy which different individuals expend under corresponding conditions and circumstances. For the "nervous" person seems peculiarly subject to either the development of any thyroid abnormality or after its development, to its intensification. All thyroid abnormalities, as stated above, seem regularly to begin with simple hypertrophy, which is most reasonably interpreted as a multiplication of all the glandular elements to compensate for demands for a greater amount of thyroid secretion than the gland of natural size can supply. Activity in any organ is normally followed by fatigue and, at least, partial cessation of function. In the case of the thyroid, the presumable compensatory hypertrophy which seems to be the first regular response to active functionation in the production and expenditure of energy, should be followed by fatigue and deficient functionation. This seems to be represented by the manifestations of hypothyroidism, or the second regular stage in thyroid disease. The other or later stages are apparently only evidences of a more intense degree of the same fatigue, although the reasons which cause one thyroid to undergo colloid or cystic or fibrous degeneration and another to undergo the changes and give rise to the symptoms of either myxoedema or exophthalmic goitre, are entirely unknown. It seems possible, however, that the different directions in which thyroid abnormalities may advance are in some measure determined by the behavior of the fatigued thyroid epithelium in its attempt to metabolize iodine. In myxoedema, the epithelium atrophies, and in hyperthyroid conditions it multiplies too rapidly and disintegrates, while the cystic goitres may involve a mechanical problem. Many of the latter forms of goitre evidently develop from more or less sudden hemorrhages into the substance of the gland. It is not impossible that the phenomena of hyperthyroidism involve some vicious circle in which the adrenals

hence it seems impossible that the tachycardia is directly traceable only to the excessive amount of the thyroid product. Six of these eight cases, or all I afterward saw, though presenting no appreciable objective abnormality, did not consider themselves well. They were decidedly asthenic rather than neurasthenic.

The worst results in these sixty-two cases seemed to have occurred in subjects who were operated on before they had attained their maximum growth and development, that is, before the age of twenty-five, and in those who had small goitres. The patients who described their goitres as symmetrical before the operation were apparently more subject to relapses than those who had the enlargement more on one side than the other. These statements are not, however, entirely trustworthy, and in many of the earlier cases were not inquired into. In respect to the more indefinite signs, those who presented the extreme manifestations of "nervousness," which has been defined above as marked sensitiveness to environment, seemed most prone to bad results.

All of the sixty-two cases complained of a greater or less amount of asthenia, or inability to expend the normal amount of mental and physical energy, and a considerable majority showed a blood-pressure above 140 mm. of mercury, and it is noticeable that the few I have been able to follow have from year to year shown a more or less steady increase in their blood-pressure. A large proportion of these cases have shown some signs which I interpret as those of hypothyroidism, although many in conjunction with the hypothyroidism have presented a more or less constant tachycardia.

With the exception of the few successful, or partially successful, secondary thyroidectomies, the only treatment which I have found beneficial for these cases has been rest in combination with organ therapy. The most frequently useful organ, especially for those with high blood-pressure, has been the adrenal proteins which contain no adrenalin. The pituitary, the thymus or the pancreas have seemed indispensable for the relief of others. The indications for the particular organ cannot be clearly described and have practically been ascertained by experiment in each case. A few seemed most relieved by a combination of thyroid with some other organ feeding.

Of the sixty-two poor or bad results of partial thyroidectomy for hyperthyroidism, my own contribution has been only nine, but this is too large a proportion of my cases to be at all satisfactory, as I have been an opponent rather than advocate of the operation. The impressions derived from these experiences can be summed up as follows: That partial thyroidectomy is to be especially avoided in patients who

produce a diseased secretion But to prevent relapse, some organ therapy, generally thyroid feeding, has, in my experience, been subsequently helpful The excision of any goitre ought, theoretically at least, to be accompanied by the sacrifice of as little normal gland as possible, and should be by enucleation rather than thyroidectomy, and during convalescence thyroid feeding, if it produces no ill effects, is logical

Treatment of Hyperthyroidism —The treatment of hyperthyroidism by the removal of one lobe or one lobe and the isthmus of the diseased gland can undoubtedly yield perfect and lasting cures These, according to statistics which include hundreds of patients, amount to between 50 per cent and 75 per cent of all the cases so treated The mortality from the operation is between 1 per cent and 6 per cent, but would probably appear as higher if the statistics of all operations were obtainable The hesitation in the general acceptance of this radical treatment is not only because of the mortality risk but also because of the uncertainty in the result, as at least one out of every four or five patients is not definitely cured Knowledge of the causation and pathology of the disease is not yet sufficient to safely select the cases I have observed, and have more or less complete records of, sixty-two patients who have applied for relief after one or more partial thyroidectomies The condition of the majority of these individuals was comparatively good and they seemed to have been at least improved by the operation Only the minority had failed to show any benefit and a considerable part of this minority stated that they were worse than before the operation An analysis of all these cases, however, has failed to yield any very definite rules for avoiding poor results Thirty-eight, for example, showed the presence of exophthalmos, and twenty-four did not, though some of them said that it was present formerly Tachycardia was present and so had not been relieved in thirty-five Eight of these, after receiving little or no benefit from my efforts, were later subjected to more extensive thyroidectomy, and five were thus cured of their rapid heart action If enough of the gland is ultimately removed, or removed in successive stages, the pulse rate can evidently be reduced, but it probably cannot be reduced by removing more than two-thirds of the gland at once

I assisted several years ago in an almost complete thyroidectomy for moderate hyperthyroidism, which the operator performed with great skill and gentleness The patient, however, died thirty-six hours afterward with the usual extremely rapid pulse Little or no secretion could have been pressed out of the gland, and practically no gland remained,

organ therapy appeared to offer a better prognosis. The results have proved its great advantages over the serum treatment alone, but have been extremely difficult to compare convincingly with the results of radical thyroidectomy.

Two hundred and eight cases (before August, 1913) have been treated by the ligation and division of one or more of the thyroid vessels which must include the nerve supply of the gland, and among these have been four operative deaths. One from the ligation of one superior group of thyroid vessels, one from the simultaneous ligation of the two superior and one inferior vessels. Both of these cases were operated upon under local novocaine-adrenalin anæsthesia. The other two deaths followed the ligation of the two superior groups of thyroid vessels under general anæsthesia. All four of these cases were severe types of the exophthalmic stage of the disease. In addition, there have been two deaths at remote periods, or one year and two years after the operation, one from the accidental ingestion of a poison, and one from pneumonia, both of these were exophthalmic cases who had made an almost perfect recovery after the ligation of both superior and both inferior vessels. Eighty-four per cent of the deaths among all the cases of hyperthyroidism which have come under my observation have presented to a greater or less degree the symptom of exophthalmos.

The condition, or what is here assumed to be the stage, of hyperthyroidism represented by exophthalmic goitre is seldom perfectly cured by any method of treatment, and in an attempt to improve upon these results I have practised under local anæsthesia in two stages the ligation, and generally the division of all four of the chief thyroid vessels in a considerable proportion of these cases, and there has occurred no resultant myxœdema or other disastrous results. It was hoped that the quadruple ligation would not have to be supplemented by any other treatment, but later experience has proved that about half of the cases would improve up to a certain point and then remain stationary in a stage of ill health characterized chiefly by nervous irritability and asthenia, and a blood-pressure above 140 mm of mercury. The tachycardia might or might not be noticeable. Further improvement seemed then only obtainable by some organ feeding. The adrenal proteins mentioned below have been the most frequently employed. One case seemed to require pituitary feeding, and another thymus, and several seemed to obtain most help from a pancreatic product. To judge of the ultimate results of any treatment, about one year should elapse after its completion. I have, therefore, selected

for report the cases of exophthalmic goitre in which both superior and both inferior thyroid vessels were ligated in two separate operations before January, 1913

The superior vessels are reached by the usual transverse incision, and the tips of the lobes have generally been included in the ligature and excised to ensure the division of the arteries. The lower arteries have been reached through a vertical incision over the lower end of the posterior border of the sternomastoid. The approach exposes and passes in front of the phrenic nerve on the scalenus anticus. The inferior thyroid can then be felt and reached behind the internal jugular and common carotid. There seems to be little or no pain sense in these deeper parts of the neck.

The improvement after quadruple ligation of the thyroid blood supply, which must include the lower nerve supply and generally all or most of the upper, is not as rapid as after partial thyroidectomy, but the operation seems to be more certain in its results and less dangerous to life, and the patient has less subsequent risk of relapse even under the conditions and circumstances which seem to produce thyroid abnormalities. In the case of partial thyroidectomy these must be removed and for at least one year or a relapse is very probable. After quadruple ligation, however, hygienic measures are desirable, but their perfect observance is not essential for a cure. In two of my earlier cases the improvement became stationary, apparently because of the continuation of the unfavorable environment, and exploration revealed a reformation of one or more arteries at the upper poles of the thyroid, probably from small collateral branches not secured at the primary operation. It is technically difficult to be sure of securing all the twigs given off from the superior thyroid, especially in a nervous subject under local anæsthesia. General anæsthesia seems to add materially to the risks, and is to be avoided according to the experiences of most operators. Hence, if any evidence of delay in recovery or relapse appear there should be no hesitation in advising secondary operation to reobliterate the probably new circulation at the upper poles of the gland. Resection of the tips of the lobes seems to be better than simple division of the upper vessels. In judging of the results, the general condition is of more importance than separate symptoms.

Before January 1, 1913, thirty-six cases of typical exophthalmic goitre had been subjected to quadruple ligation. All had symmetrical or nearly symmetrical thyroid enlargement. The operations on all except two of the patients were done under local, or novocaine-adrenalin, anæsthesia. There were no deaths as a result of the

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operation, and no failures to effect improvement. Twenty-five now consider themselves well, and are able to lead normally active lives. Two others were in this group, but one operated in 1910 died suddenly in July from accidental poisoning and the other from pneumonia in August, 1913. Twenty-seven practical cures were thus obtained. Eleven of these present no traces of any abnormality. The remaining sixteen present more or less perceptible thyroid enlargement. Nine of them show some tachycardia after exertion or excitement, and two others show a decreasing but still perceptible exophthalmos. The nine who are not "cured" all appear in a good state of nutrition, but cannot perform ordinary work. One of these was a "trained nurse" who completely recovered, then relapsed after resuming work, again recovered after a rest and again relapsed after undertaking night duty in a hospital. She then was subjected to partial thyroidectomy, and now three months later seems in perfect health, but will it last? The other eight still present more or less thyroid enlargement, tachycardia and exophthalmos, and all have the characteristic of nervous irritability but seem to be slowly gaining, and are unwilling to risk a thyroidectomy. They all are alike in receiving apparent benefit from feeding with the adrenal proteins mentioned before. It, therefore, seems fair to claim for the operation of quadruple ligation of the thyroid vessels in cases of exophthalmic goitre a somewhat better prognosis than for thyroidectomy. The ligation of vessels is comparatively harmless, and has yielded 78 per cent of practically perfect results and no complete failures. The tachycardia, however, subsides only in the course of weeks and does not disappear rapidly as after partial thyroidectomy. There is also some danger of relapse but the relapse seems to be less serious than after the more radical operation.

The recovery of the majority of cases can be materially hastened by some form of organ therapy, and for a few this treatment seems a necessity. Adrenal, pancreas, ovary, thymus, pituitary or thyroid.²

² The thyroid products which have been employed are made in tablet form in the department of experimental therapeutics of the Cornell Medical College. The thyroid tablets are prepared by suspending hashed pig or sheep glands in normal salt solution in an ice box for 36 hours. The coarser particles are then removed by straining through gauze and the filtrate is then passed through filter paper in a Buchner or suction funnel. This second slightly cloudy filtrate is then warmed for 10 minutes to 44° C and 10 per cent acetic acid added until no more precipitate occurs. The separated precipitate is dried and standardized according to its iodine content and put up in tablets containing 1 per cent, 2 per cent, 5 per cent, and 10 per cent of iodized proteins, and these are roughly equivalent to about ¼, ½, 1 and 2 grams of the commercial dried

feeding have seemed helpful or necessary in about this order of frequency—thyroid feeding was beneficial in only two or three typical exophthalmic goitre cases who were subjected to the quadruple ligation and then was combined with adrenal feeding. Adrenal feeding is generally useful in those with a blood-pressure above 130 mm of Hg. A combination of pancreas and adrenal feeding generally produces diarrhoea and these two organs seem incompatible. Pancreas feeding is usually helpful in cases with intestinal fermentation, especially when there is insomnia. Thymus or pituitary seems most helpful when there is a pronounced tendency to stoutness and asthenia is prominent. But no rules can be formulated and the most helpful organ therapy must generally be ascertained by experiment.

powder. But the laboratory tablets are more beneficial and far less likely to excite the hyperthyroid symptoms. They are very useful in the common types or stages of functional thyroid disease in which the symptoms show evidences of mixed hypo- and hyperthyroidism. The other organ products are prepared in the same way, but cannot as yet be standardized. Like the thyroid tablets they seem more beneficial than the commercial substances made from dessicated glands. The dosage of the adrenal pancreas thymus and ovarian proteins is from $\frac{1}{4}$ to 2 grains—that of the pituitary proteins is seldom over $\frac{1}{8}$ grain.

HOW SHALL THE CLINICIAN INTERPRET THE WASSERMANN REACTION ? *

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At the present time it may be said that the attitude of clinicians toward a Wassermann reaction has divided them into three groups

Those who depend absolutely upon a Wassermann for diagnosis

Those who discard a Wassermann reaction as of no value

The third group, who from their experience in syphilis, and a careful study of the Wassermann reaction in every case of syphilis, of many reactions made by different serologists, and by series of reactions made at frequent intervals upon patients under treatment, have learned what to expect in practically every phase of the disease

Of the three groups of clinicians, the first are the most dangerous, as to interpret a positive Wassermann as a positive indication of syphilis is erroneous. The second group, while less dangerous, deprive their patients and themselves of a most valuable adjunct in diagnosis, prognosis and treatment. The third group are those who are prepared to give themselves and their patients the advantages of the numerous important data that may be obtained from a properly performed test, and at the same time safeguard him against the evils, which might result from an incorrect interpretation of the same. From a careful study of a great number of reactions made upon those suffering with syphilis, in all stages of the disease, and under nearly all types of treatment, a number of conclusions may be drawn, which will be of assistance to the clinician in checking up the accuracy of a Wassermann report

In our observation, the Wassermann reaction in the initial stage of syphilis never became positive before the fifth day, and was always positive in cases seen after the fifteenth day. To wait for a positive Wassermann reaction to confirm the diagnosis of a clinically suspicious ulcer, deprives the patient of the one time in the whole course of his disease, that a rapid and almost certain cure can be expected. The same may be said of clinical diagnosis, that usually when the clinical diagnosis is without question, it is too late to expect a rapid and certain

* Read before the Philadelphia Academy of Surgery, February 2, 1914

destruction of the spirochætal infection. The diagnosis should be made from the presence of the spirochæta which are most easily detected by dark field illumination, and the Wassermann test should guide the prognosis. We have never observed syphilis to become a constitutional disease, either clinically or serologically, when energetic salvarsan or neosalvarsan treatment was instituted in a chancre with a negative Wassermann. From the above it may be deduced that the Wassermann as a diagnostic means in primary syphilis is of minor importance compared to its value in prognosis. Positive spirochæta pallida is diagnostic of the initial lesion, and should always check up a positive Wassermann or clinical judgment. A positive Wassermann in conjunction with a positive spirochæta pallida announces the onset of constitutional syphilis, and alters to a considerable degree the prognosis.

In secondary syphilis, untreated, the clinical judgment usually suffices for diagnosis, and the properly performed Wassermann test confirms it, but the clinician who neglects its performance, deprives both himself and the patient of valuable data that may be used in prognosis, and as a guide as to the efficiency of treatment. A properly performed test not only tells us that the patient has syphilis, but the degree of constitutional infection, or amount of natural resistance. It is, indeed, surprising how variable is the degree of positiveness of the serum reaction in patients with syphilis in similar stages of the disease, as a rule, the higher the degree of positiveness, the more energetic and prolonged must the treatment be to reduce it to negative, and so much more zealous the physician must be to guard against clinical relapses. When in clinically doubtful manifestations of secondary cutaneous syphilis the Wassermann is positive, the clinician has a perfect right to reject the Wassermann in favor of his clinical opinion, until by the subsequent course of the case, he proves to his satisfaction that syphilis does or does not exist. He should also in the best interest of the patient submit the blood to different serologists. The report that he obtains will give him valuable information as to the element of "personal equation," which always exists in the work of human hands, however, the possibility of a latent coexisting syphilis must always be thought of.

In active tertiary syphilis, again the Wassermann usually confirms the clinical picture, but, as in the secondary stage, is of value in prognosis, and as an index to treatment. Clinical experience and the Wassermann reaction teach us that tertiary syphilis is difficult to eradicate and relapses, both clinically and serologically, are frequent,

and that a reasonable assurance of cure is but a remote possibility. To obtain a negative Wassermann with treatment of any kind, requires that the treatment be very energetic and prolonged.

The Wassermann reaction has confirmed the clinician in his views, that hereditary syphilis is least influenced by any form of treatment, and has thrown considerable light upon the etiology of many of the diseases of special organs, notably the eye, ear, brain and cord, which were formerly more or less obscured. In syphilis of special organs, the interpretation of the accuracy of a Wassermann reaction must be left to those familiar with the clinical manifestations of the disease, as it must be left to the syphilologist in the manifestations of general constitutional syphilis. In the presence of questionable lesions of syphilis, we regard the Wassermann reaction as of subsidiary importance to clinical experience, from the diagnostic standpoint, and no physician should accept a positive Wassermann as a positive indication that the patient has syphilis, but should regard it as but one of the symptoms or signs of the disease, which goes to build up the general clinical picture as ascertained from a careful history and physical examination of the patient. In the absence of clinical symptoms, the Wassermann reaction again should not be absolutely relied upon, for as in the present day many are pronounced syphilitic upon the strength of a positive Wassermann test, so in days gone by were they adjudged syphilitic upon insufficient clinical data, and it is here that the most careful history regarding the character of the lesions upon which the diagnosis was based, the time at which the treatment was begun, the method employed, the length of time continued, the occurrence of lesions which indicate relapses must be sought for, and the probabilities for or against infection established in the clinician's mind. When the probabilities of syphilis and the reaction agree, all well and good, when they disagree the blood should be sent to different serologists before judgment is pronounced.

The influence of treatment upon syphilis, from the standpoint of serum reaction, depends upon when treatment was instituted, how long it was continued, the drugs employed, and the method of their administration. One thing is certain, syphilis as treated in the past has not been efficient, its prevalence and the number of diseases caused by syphilis is proof of this assertion. A two or three years' course of mercury treatment is only followed by a negative Wassermann in fifty per cent of cases. A negative Wassermann of a patient under treatment is not an indication of a cure, but is an index of the efficiency of the treatment, and our aim should be to reduce the Wassermann to

negative in the shortest time by most energetic treatment, and so maintain it over an indefinite time, as evidenced by repeated negative reactions. In a patient so treated, a positive Wassermann reaction following one or a series of negatives is the earliest indication of the activity of a heretofore latent infection.

In conclusion, it may be stated that the serum reaction, properly performed, is such a valuable aid to the clinician, that it should be made only by those thoroughly trained in serology. The clinician should never rely upon the Wassermann reaction absolutely in diagnosis. As the serum reaction offers the possibility of so many errors in technic and reagents, it is essential that the closest relationship should exist between the clinician and the serologist, in order that accurate and reliable results may be obtained. As clinicians, we strongly urge that a uniformity in technic and a standardization of reagents be adopted by serologists. From our experience with the serodiagnosis, we have found the "single unit system," as introduced by Dr. John L. Laird, to furnish the clinician with the most accurate data, for by this method the exact quantitative results as expressed in units can be estimated.

OBSERVATIONS ON THE PATHOLOGY, DIAGNOSIS AND TREATMENT OF SEMINAL VESICULITIS *

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THE motives responsible for the presentation of this contribution are two-fold First, we desire to impress, as forcibly as may be, the medical profession at large with a fact—our solemn conviction—namely, that two small organs, the seminal vesicles, too often disregarded and neglected, if not forgotten, have not received the consideration which is their due as foci of infection, and in the near future will be their demand especially at the hands of neurologists, orthopædists and internists We refer to a vast array of conditions with a symptom-complex too little understood, as acute and chronic synovitis and arthritis, of an infectious or toxic nature, so-called articular and even muscular rheumatism, rheumatoid arthritis, arthritis deformans, gout, hypertrophic arthritis, chronic bladder disturbances, recurrent epididymitis, impotency, renal and cardiac complications, digestive disturbances and an ensemble of mental and nervous manifestations almost incredible of belief Obviously, it is not inferred that in the above-mentioned diseases, the vesiculæ seminales are always concerned, but we believe that the medical profession in general would be amazed if not embarrassed to learn how frequently in certain infective, cryptogenic, nervous and arthritic conditions, the depot of infection will be found to be a chronic seminal vesiculitis Fuller¹ states that “tuberculous joint, arthritis deformans, gout, chronic inflammatory rheumatism, progressive muscular atrophy and myelitis of some form are among the diagnoses previously made in cases cured through the performance of seminal vesiculotomy Of eighty-nine rheumatic patients there was not one who was not relieved in a most radical manner and who was not satisfied

* Read before a joint meeting of the Academy of Surgery and Philadelphia Genito-urinary Society, February 2, 1914

¹ Fuller “Seminal vesiculotomy,” *Jour A M A*, November 30, 1912,

with the operative result " Second, we wish to make an announcement of work undertaken in a comparative study of various methods of treatment for this common disease, also at this time to submit a number of collargol radiograms illustrative of the normal and diseased seminal vesicle in a study of the living pathology of these organs

It is remarkably strange, but nevertheless true, that with two structures as intimately associated as are the prostate and seminal vesicles, that the former should have been so thoroughly studied years ago, while the pathology and diseases of the latter, in text-books universally, have been alluded to casually or definitely neglected The profession owes a debt of gratitude to Fuller² and Lloyd, pioneers in this line of work, for their untiring efforts in directing attention to the importance, constitutionally, of seminal vesiculitis and for suggestions as to treatment

It must be apparent to all that by virtue of the relatively larger lumina of the ejaculatory ducts as compared with the prostatic ducts, that infection in the posterior urethra can and does reach the seminal vesicles more readily than the prostate Indeed, it has been our experience that over 90 per cent of gonorrhoeal patients exhibit posterior urethritis and that 90 per cent of posterior urethritides are complicated by prostatitis Thus the percentage of seminal vesiculitis in the male population is very high

For a thorough comprehension of the importance and magnitude of this disease in its correlation with various other systemic disorders, certain facts relative to the anatomy, bacteriology and histo-pathology of these organs must be understood In 1911 Picker,³ before the III Congress of German Urologic Society, presented a classic study, in which he examined about 150 seminal vesicles, dissecting out the tube systems after injecting the vasa deferentia with bismuth paste From material comprising 56 normal and 16 pathological specimens, he makes the following anatomical classification (1) Simple straight tubes (2) thick twisted tubes with or without diverticula, (3) thin twisted tubes with or without diverticula, (4) main tube straight or twisted with larger grape-like arranged diverticula, (5) short main tube with large irregular ramified branches, (6) miscellaneous, comprising (a) embryological abnormalities and (b) pathological conditions Of the normal specimens about one-third belonged to types (1), (2) and (3) and two-

² Fuller *The Jour A M A*, May 4, 1901, p 1228, *Med Rec*, New York, October 30, 1909, *Jour A M A*, November 30, 1912, p 1959

³ Picker "The Anatomical Configuration of the Human Vesicula Seminalis in Relation to the Clinical Features of Spermacystitis" Paper read before the XIV International Medical Congress, London, 1913

thirds to (4) and (5) The lengths of the various vesicles measured from 6 to 23 cm , the capacities varied from 3 to 115 cc Thus it is seen that the seminal vesicles, of all the associated glandular structures of the male urethra, possess the most extensive secretory surface with the worst drainage

In the majority of the types found, short spontaneous healing is anatomically and mechanically impossible, practically always so without massage, sometimes requiring months, and consequently latent foci of infection result

Just as a pure gonorrhœal cystitis is a condition that probably never exists, so too are most, if not all, infections of the seminal vesicles and prostate mixed This supposition is confirmed by bacteriological examination of the inflammatory products obtained after massage of these organs Among the bacteria harbored in chronic seminal vesiculitis, that have been repeatedly demonstrated, may be named the gonococcus, various strains of streptococci, pneumococci, staphylococci, colon bacilli, corynebacteria and tubercle bacilli It is highly probable that in many cases diagnosed as "gonorrhœal rheumatism," the gonococcus has ceased to play a rôle and that the offending bacterium can be traced to a mixed infection located in a chronic seminal vesiculitis The clinician should readily appreciate the significance of such bacterial foci so far as systemic affections are concerned, and in comparison with the tonsil, it would seem to us that the greater evil rests with the seminal vesicle in the light of clinical experience and specific treatment. Yet how many male patients in our hospital wards and private practice, exhibiting certain rheumatic and nervous manifestations, are submitted to any examination per rectum, not to mention a proper investigation of their seminal vesicles?

Again extensive tissue changes supervene in severe grades of infection In addition to intravesicular inflammation and loculated accumulations of exudate composed of pus, various bacteria, etc , an interstitial spermacystitis occurs in many cases, resulting in thickening of the vesicle wall Indeed, commonly it is the case that perivesicular infiltrates form about the base of the bladder and prostate and extend through the perirectal tissues, occasionally pointing in the perineum or rupturing into the rectum or bladder

Convinced, therefore, of the prevalence of this disease and the often remote effects produced by its existence, necessitating greater consideration on the part of all physicians as to precision of diagnosis and the adoption of the best form of treatment, we have been engaged recently in a partial study of this problem The treatment of seminal vesiculitis

comprises a number of methods. Appropriate, intelligent and efficient *massage* is unquestionably the best procedure primarily in the average case and will suffice to effect cure in the majority. In not a few cases the accessory value of *autogenous bacterins* may be utilized with gratifying success. Occasionally, spontaneous cures, after a long time, will occur. In each patient the proposition should be viewed from the anatomico-pathological stand-point. Thus, the following considerations arise: (1) Is the ejaculatory duct strictured or obstructed? (2) Is the vas deferens strictured? (3) Is the inflammatory collection in the seminal vesicle loculated? Belfield, in the consecutive examination of 25 cadavers, found the ejaculatory ducts strictured on both sides in 1 case and unilaterally in 2 cases. Aschoff found the deferentia strictured bilaterally in 6 and unilaterally in 17 cases, in an examination of 1000 subjects. Assuredly, if the ejaculatory duct is completely stenosed, massage will be futile as a form of treatment. On the other hand, if the vas is occluded near the seminal vesicle, *vasopuncture* or *vasostomy* and direct medication will accomplish nothing. *Seminal vesiculotomy* ardently advocated by Fuller, and performed by him with wonderful success in about 300 cases, has a definite indication in a certain percentage of cases. We prefer, however, the method of Voelcker, permitting as it does a better exposure of the vesicles and allowing freer and more definite incisions for drainage of the infected organs. *Vesiculectomy*, the most radical procedure, should be reserved for the grave, chronic cases, and, if the process is tuberculous, should be chosen in preference to vesiculotomy.

Since, therefore, operation should be considered only after massage has failed or availed naught, and since the particular operative procedure to be adopted depends upon the pathological condition present in the vesicle, ejaculatory duct or vas, it behooves the surgeon to familiarize himself with the morbid process. This knowledge may be acquired through rectal palpation and by needle puncture of the vas in an attempt to inject a normal amount of solution, as boric acid, into the seminal vesicle. In place of boric, collargol in ten per cent solution, as suggested by Picker⁴ and Belfield,⁵ may be utilized and has the additional advantage of permitting radiographic studies of the living pathology. In addition to its diagnostic value, collargol possesses also a definite therapeutic effect. It has occurred repeatedly during the past few months that after these collargol injections there has followed a reduc-

⁴Picker *Loc cit* (Collargol preparation No 57)

⁵Belfield *J A M A*, p. 800, March 15, 1913, p. 1867, November 22, 1913, *Surg, Gyn and Obst*, p. 569, May, 1913, November, 1906

FIG. 1



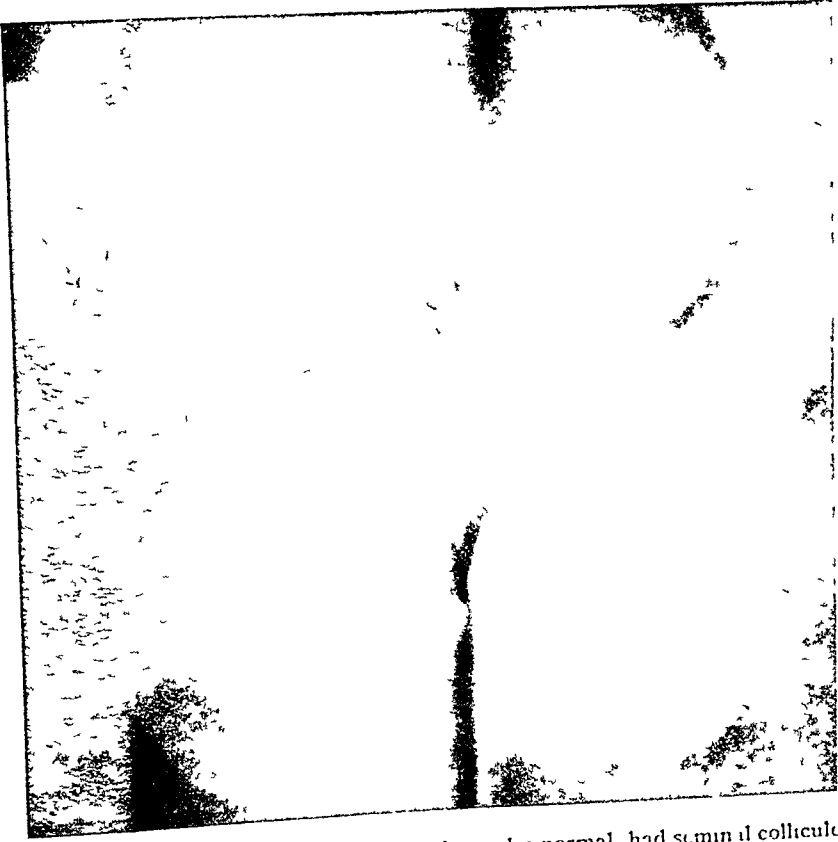
Drawing of dissection by Dr. Addinell Hewson of normal seminal vesicle showing their relationship to the ampullae of the vasa deferentia, the ureters, the bladder and the prostate

FIG 2



Collargol radiogram of anatomical specimen shown in Fig 1. The right seminal vesicle has been injected through the vas with three cubic centimetres of collargol, the left vesicle has been slightly injected. Observe the leakage of collargol through the right ejaculatory duct into the urethra. Both ureters have been catheterized with radiographic catheters defining their relationship to the vesicles and vasa deferentia.

FIG 3



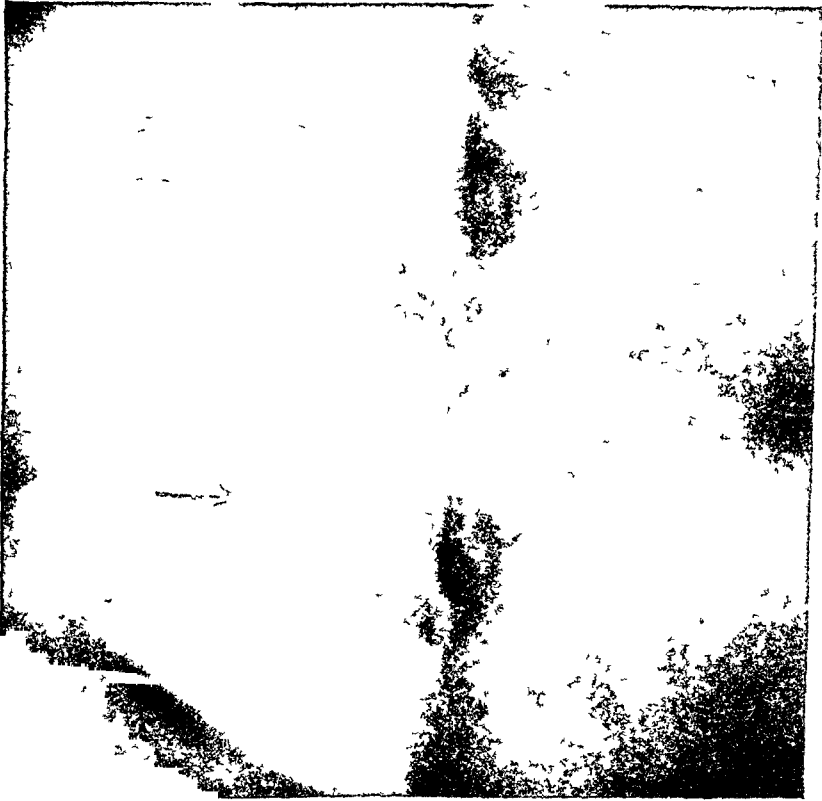
Patient never had venereal disease, seminal vesicles normal had seminal colliculotomy for fibroma one month prior to collargogram. Note tortuosities of vas deferentia. Observe radiographic catheters in ureters and relationship of same to vesicular seminal ducts.

FIG 4



Chronic seminal vesiculitis Each side injected with fifty minims of collargol. Clin-
ically by palpation there existed a nodule on the right side evidencing a loculated collection
of pus or seminal pyovesiculosis This is confirmed by the shadow in the skiagram

FIG. 5



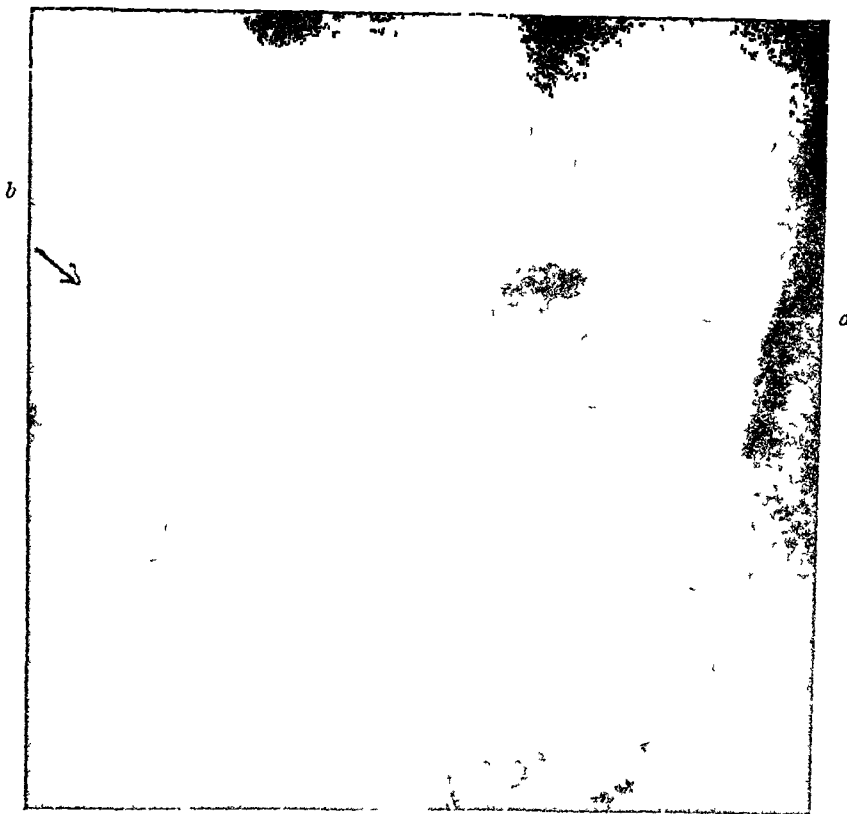
Chronic seminal vesiculitis. Sixty minims of collargol injected in each side. Clinically the right vesicle is nodular on palpation and radiographically seems to demonstrate partial obliteration of its lumen.

FIG 6



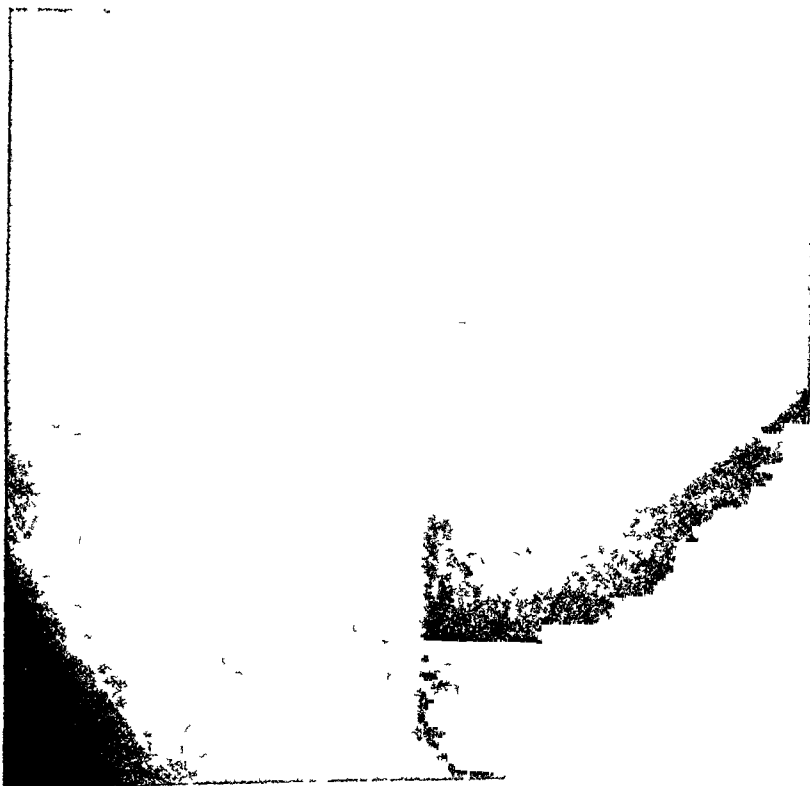
Chronic spermocystitis Sixty minims of collargol injected on each side Clinically cured

FIG 7



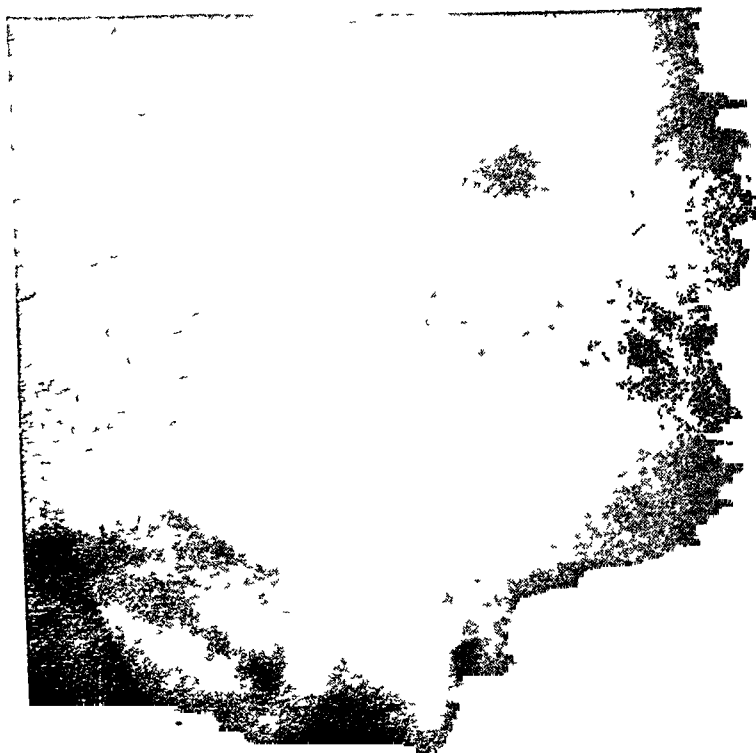
a chronic seminal vesiculitis (left), *b* stricture and complete occlusion of right vas deferens. A small shadow shows the extent of collargol injection on the right side, only twenty minims were injected. The left vesicle injected with sixty minims was clinically enlarged and tender.

FIG 8

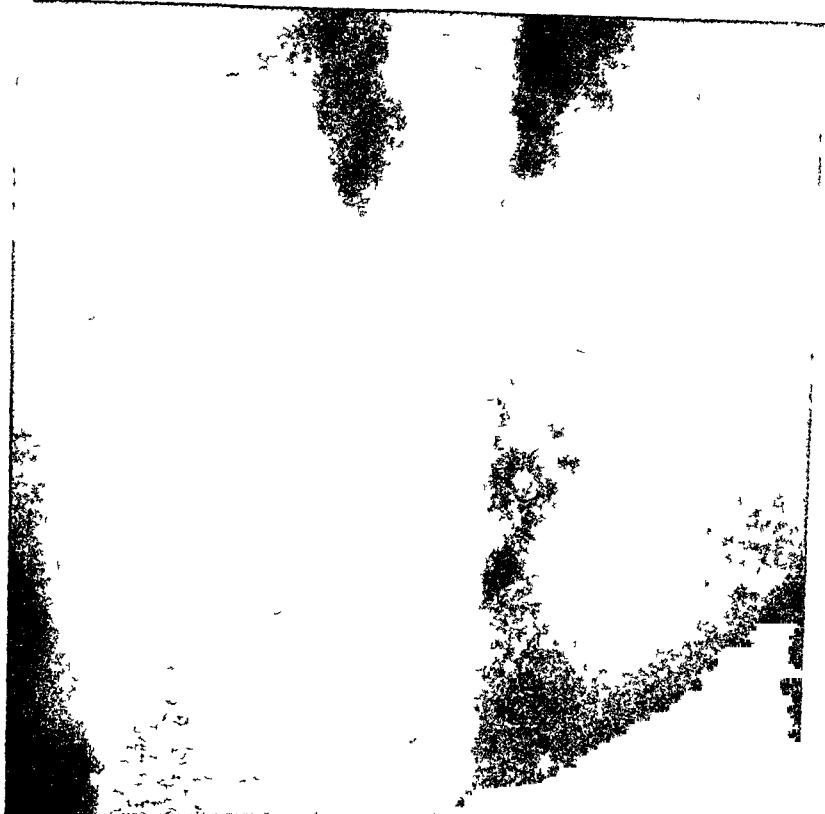


Chronic seminal proovesiculosis. Fifty minims of collargol injected into each side.

FIG 9

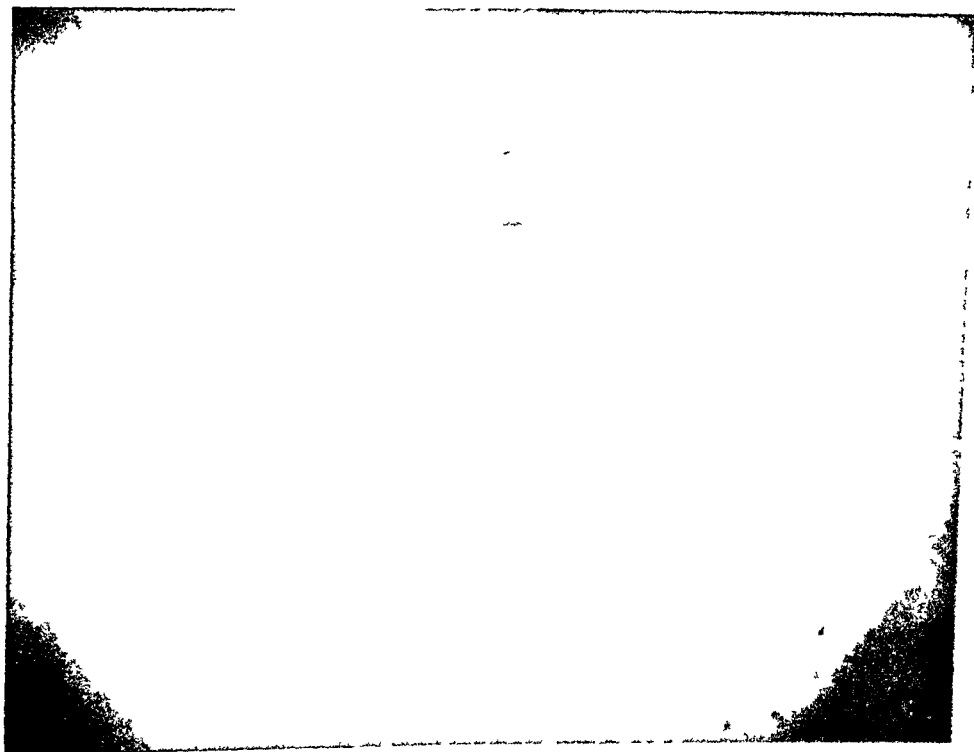


Subacute seminal vesiculitis Each side injected with 70 minims of collargol Observe the courses of the vasa deferentia



Chronic seminal vesiculitis (right) - normal vesicle and injected vas throughout its course on right side - collargol injected on each side

I 11



Chronic seminal vesiculitis (bilateral) - Eighty minims of collargol injected on right side and seventy on left - Note very large ampulla of vas deferens and course of the latter on both sides

SEMINAL VESICULITIS

tion to the normal in the number of pus cells expressible from the seminal vesicles, the thought has occurred that this procedure may be the means of aborting an acute seminal vesiculitis. Moreover, in a number of cases this operation has been followed by the disappearance of reflex perineal, pubic, urethral, vesical and neurasthenic pains. Sufficient time has not yet elapsed to judge of the permanency of these results or possible cures. In the near future, a study of the comparative effects, therapeutically, of various other medicaments, as emulsion of the iodide of silver, silver nitrate, protargol, hegonon, etc., will be reported.

The technic of this collargol or other drug injection of the seminal vesicle or operation of *vasopuncture* is very simple. With a good assistant holding and fixing properly the vas in the neck of the scrotum, the duct can be exposed after cutaneous infiltration anaesthesia in a very few minutes. If care is taken to strip it of its most intimate sheath and a proper sized needle is selected for the puncture, little difficulty should be experienced in injecting the medicament, using from four to five cubic centimetres. A Crile clamp is placed on the vas distal to the puncture, while injecting the collargol. A suture of catgut in the fascial sheaths and one in the skin completes the procedure. The patients invariably experience more or less pain in the perineum and not a few develop a chemical funiculitis of two or three days' duration. Indicative of therapeutic effect, the urine appears dark brown or black for a couple of days and shows macroscopically the presence of collargol for about a week, microscopically, brown crystals of collargol, particularly after massage, are seen for a much longer time. There is some evidence to show in a few cases that simple puncture and injection, as described, will render vasostomy, as described by Belfield,⁵ unnecessary, moreover, the puncture method or operation of vasotomy may be repeated from time to time if desirable.

We have selected from our series of cases a few collargol radiograms typifying a number of conditions encountered. First, in studying the anatomy and relations of the normal seminal vesicles (Fig 1), for the preparation and dissection of which we wish to thank Dr Addinell Hewson, it will be observed in comparing the collargol injected anatomical specimen (Fig 2) with the clinical cases following, that we have apparently graphic evidence of the presence of a sphincter of the ejaculatory duct, since only in the anatomical specimen is the collargol visible in the duct. Observance should also be made of the relationship of the ureter to the seminal vesicle, since it will be appreciated how in the case of seminal pyovesiculosis or perivesiculitis, ureteral irritation or even urinary obstruction may supervene.

In summarizing our studies the following conclusions have been deduced

1 Chronic seminal vesiculitis is a far more prevalent disease than the average physician surmises, and masquerades under a manifold symptomatology finding its expression oftentimes remote from the urinary tract, the inflammation is invariably due to a mixed infection, from which in its chronic state it is commonly impossible to isolate the gonococcus

2 The disease, analogous to pus-tubes in the female in many respects, presents serious and similar problems from the stand-point of treatment, and is not accorded the consideration that its medical importance demands

3 The particular treatment in any given case should depend upon the anatomico-pathological state of the vesicles, ejaculatory duct and vas deferens This can be determined by proper vesicular palpation, massage and microscopical examination, supplemented when necessary by vasopuncture and collargol radiography

4 Experienced massage will in the majority of patients suffice to effect cure in due time, in many, however, massage having proved ineffectual, convalescence may be accelerated by vasopuncture, vasotomy and direct medication of the seminal vesicles, in certain cases, not so few as may be imagined, seminal vesiculotomy or vesiculectomy should and must be performed if we are to cure or relieve these patients of their annoying symptoms

5 Bilateral vasopuncture and collargol medication has resulted at least in the temporary cure of a number of cases of persistent chronic seminal vesiculitis

6 Collargol radiograms in a series of normal and pathological cases have demonstrated, (a) by comparison *in vivo* an *in vitro*, the graphic portrayal of an ejaculatory duct sphincter, (b) the intimate relationship between the ureter and seminal vesicle, whereby ureteral irritation and urinary obstruction may occur in the event of an enlarged and inflamed vesicle, (c) the presence of stricture or obstruction of the vas; (d) congenital anomalies of the vesiculæ seminales, (e) inflammatory enlargements of the vesicles, especially loculated collections of pus or seminal pyovesiculositis

THE TREATMENT OF BLADDER PAPILLOMA BY HIGH FREQUENCY DESTRUCTION*

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THE destruction of living tissue by the local application of the high frequency current has been used with success in the treatment of tumors of cutaneous surfaces, and accessible mucous membrane Dr Edwin Beer was the first to successfully employ this method in the treatment of bladder papilloma The application of an electric current of high tension on living tissue, produces various changes from simple hyperæmia to carbonization, terms such as fulguration, desiccation, high frequency cauterization, and thermocoagulation, have been applied to these thermic effects Fulguration, first described by Dr de Keating-Hart, is merely the production of hyperæmia in an operative wound by a bombardment of electrical sparks, and is never used for the destruction of tissue As this term is usually used, it is a misnomer, and destructive fulguration is used by some to differentiate it Dr William L Clark, of Philadelphia, originated the method of treatment by desiccation, which can only be produced by static apparatus, and describes it as the thermic effect produced on living animal tissue, which is within the extremes of hyperæmia and carbonization If the accurate caloric degree is produced, controlled and sustained, it causes "a rapid dehydration of the part desired to be devitalized, rupturing the cell capsule and transforming it into a dry mass" High frequency cauterization refers to the destruction of tissue by carbonization Thermo-coagulation is another term used to express the same process These last two terms have been employed irrespective of their exact meaning

The high frequency current for desiccation can only be generated by a static machine of high output fitted with the proper requisites, while the high frequency current which causes destructive fulguration, high frequency cauterization or thermocoagulation, is generated by a coil apparatus transformed by proper accessories The monopolar Oudin current is the one preferred by most operators, but the bipolar Oudin current may be used The D'Arsonval is usually employed as

* Read before the Philadelphia Academy of Surgery, February 2, 1914.

a bipolar current and produces the same effect, but is more precise. In the former the entire body acts as a capacity, while in the latter the current is concentrated by the application of another pole opposite the area treated. When these currents are generated by the electrostatic machine with Leyden jars of a certain capacity, the effect produced upon the tumor seems to cause less blanching and carbonization, the resulting necrosis is by a process of pulverization rather than sloughing.

It has been the observation of all surgeons that the operative treatment of bladder papilloma is unsatisfactory, on account of the frequency of recurrence. Since the high frequency treatment has been employed, recurrences have also been observed and the future will prove them to be as frequent as following operation, but the ease of application, the rapid destruction of small neoplasms with a few treatments, and the fact that the patient is not subjected to any of the inconveniences or dangers of an operation, recommend this method of treatment.

The technic is simple. A catheterizing cystoscope is introduced into the bladder, observing the usual precautions of asepsis. The bladder is washed clean and distended with one of the usual mediums, and a specially prepared and properly insulated steel or copper wire is introduced through the cystoscope in a manner similar to the introduction of an ureteral catheter. The electrode most commonly employed is made of a single steel wire or several strands of copper wire, properly insulated, of a size to fit the ordinary catheterizing cystoscope, about an eighth of an inch of insulation should be removed from the end of the electrode, which comes in contact with the tumor. Wappler has recently made a special electrode, which has the advantage of being more durable and less flexible, and the tip is protected by a special insulation to prevent fusing. It requires, however, a Garceau type of cystoscope for its use. The electrode is introduced through the cystoscope, and is brought into direct contact with the tumor tissue, the proximal end is attached to the terminal of the high frequency generator. The strength of the current is regulated according to the size of the tumor, the effect desired, and the proximity of the electrode to the bladder-wall. The application should not be painful. A number of applications at different points, of from ten to twenty seconds duration, have been recommended. It has been our practice to attempt the entire destruction of a small growth with one treatment, going over the entire tumor with one continuous application, interrupting the current only to change the direction of the electrode. In large growths,

FIG 1

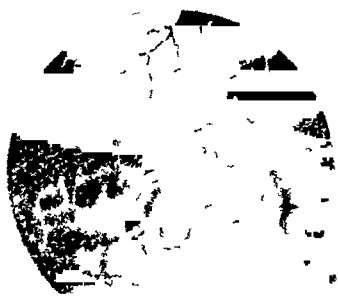


FIG 2



FIG 3

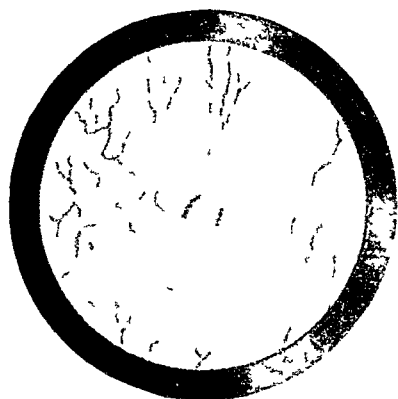


FIG 4

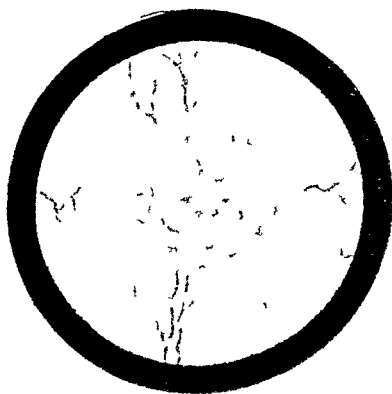


FIG 5



FIG 6

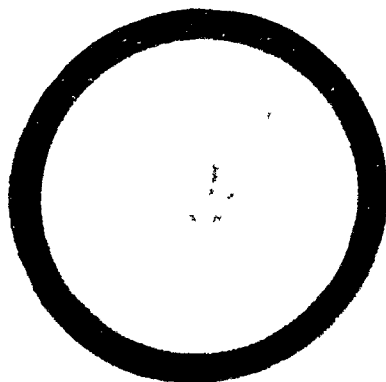


FIG 7

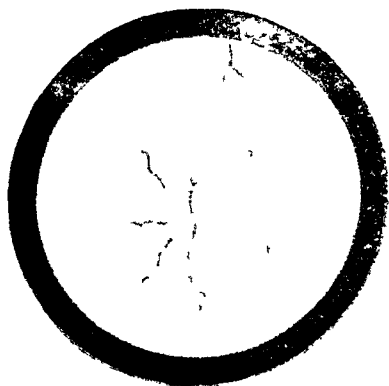


FIG 8



from the vesical mucosa, behind the orifice of the right ureter. Another on the left wall, a third on the base behind the interureteral ligament, and the fourth on the upper border of the internal vesical sphincter. A portion of the largest tumor was removed for microscopic examination, and found to be benign papilloma. High frequency current applied December 27, 1912, and January 23, 1913. Cystoscopic examination one month after the last treatment showed a normal bladder, both kidneys also normal. Examination January 6, 1914, one year after treatment. The bladder was found to be normal (Fig 3), and showed a double opening of the left ureter, which was obscured by the papilloma.

CASE III—J S, male, age fifty-eight, dye worker, referred by Dr George Yeager.

Referred for examination June 23, 1913, because of intermittent hæmaturia of three months' duration. Cystoscopic examination showed a large villous, pedunculated papilloma of the left wall of the bladder behind the left ureter. A portion was removed for microscopic examination, and was found to be a benign papilloma. He received three treatments between June 23, 1913, and July 23, 1913, and was told to report for observation in a few weeks, but failed to do so. On December 2, 1913, in response to a letter, he returned for examination, and stated that he considered himself perfectly well. Cystoscopic examination showed the return of a small papilloma at the site of the former growth, which undoubtedly was not thoroughly destroyed by the previous treatments (Fig 4). He received but one treatment, December 9, 1913. Fig 5 shows the destructive effect of the high frequency current at the time of treatment, Fig 6 shows a small denuded area of mucosa two weeks after treatment, and Fig 7 shows the normal bladder seven weeks after treatment.

CASE IV—R A, male, age forty-seven, referred by Dr M Abramovitz.

Referred August 22, 1913, for painless hæmaturia and frequent urination of six weeks' duration. Cystoscopic examination revealed a large villous papilloma occupying the entire right side and base of the bladder, extending forward beyond the internal sphincter into the deep urethra (Fig 8), and a small papilloma on the left wall of the bladder. August 26, 1913, a portion of the tumor was removed and diagnosed benign papilloma, also received the first treatment on this date. He received two more treatments in the following six weeks. Cystoscopic examination, December 2, 1913, showed a normal bladder.

CASE V—J J S, male, age sixty, referred by and treated in conjunction with Dr Wm L Clark.

Date of first examination, September 29, 1913. This patient suffered with frequent urination, and hæmaturia of a terminal type for six months. Cystoscopic examination showed a large sessile tumor on the left wall of the bladder, behind the left ureter, and surrounded by several small villous papillomas, this tumor had the appearance of a solid growth, and the pathological diagnosis was, that the tumor had the general appearance of benign papilloma, but in some places there was a tendency of the epithelium to invade the connective tissue, suggestive of malignancy. Seven treatments at weekly intervals were applied by a monopolar current from a static generator, devised by Dr Clark. On November 26, 1913, about ten days after the last treatment, the tumor had entirely disappeared, but there was a roughening of the mucosa at the site of the large tumor. The patient has not been observed since.

FIG 9



FIG 10

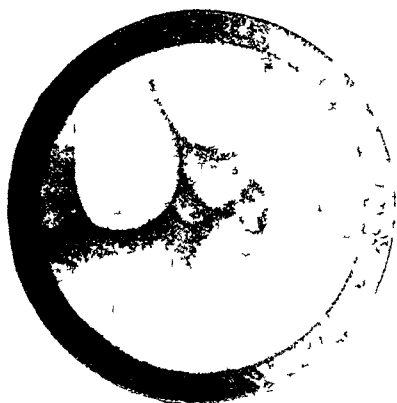


FIG 11

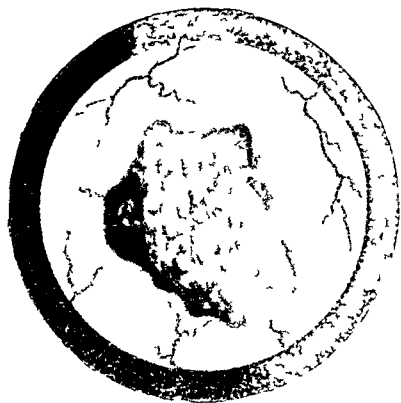


FIG 12

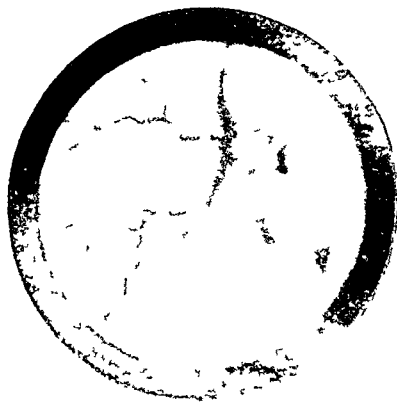


FIG 13



TREATMENT OF BLADDER PAPILLOMA

CASE VI—J M, male, aged fifty, referred by and treated in conjunction with Dr Wm L Clark.

Date of first examination October 29, 1913 For several years the patient observed frequency of urination, and sensation of incomplete emptying of the bladder In December, 1912, he noticed blood in the urine, since then he has had intermittent hæmaturia, usually lasting about a week, and never accompanied with pain In October, 1912, a cystoscopic examination was made elsewhere, two papillomas were found and treated by high frequency destruction. Twenty-one applications were made at intervals of a few days October 29, 1913, a cystoscopic examination revealed a villous papilloma the size of a hazel-nut on the upper left wall of the bladder, partly charred by the previous treatments, and a smaller sessile tumor, partly destroyed, on the base of the bladder, behind the right ureter The bladder mucosa was congested The prostate was not enlarged and no strictures were found There was considerable residual urine October 30, 1913, complete desiccation of both tumors, with the assistance of Dr Clark Two weeks later, upon examination, found no evidence of the tumors The mucosa was considerably injected The patient is still under observation

CASE VII—M L, male, age fifty-eight, referred by Dr T LeBoutillier

Hæmaturia observed for the first time one year ago, was intermittent for eight months, and constant for the past four months Has constantly received medical attention Two cystoscopic examinations were made by different observers, each of whom diagnosed a tumor. Since the last examination, four months ago, blood has been constantly present in the urine Has slight loss of weight and marked anæmia Cystoscopic examination, December 23, 1913, shows a large, sessile, non-villous tumor, occupying the entire left wall and fundus of the bladder (Fig 9) The right wall is the seat of a peculiarly shaped tumor (Fig 10) There is scarcely any part of the bladder larger than a silver quarter, which is normal December 30, 1913, high frequency treatment, repeated January 15, 1914, and January 27, 1914 The patient is still under observation, the diagnosis is still in doubt

CASE VIII—J S, male, age fifty-one, moulder, referred by Dr Harry Carmany

Seven years ago the patient noticed frequent painful urination with hæmaturia and was examined for stone This condition continued with periodic remissions to October, 1913 A cystoscopic examination by Dr Carmany revealed tumor of bladder, and the patient was referred, October 15, 1913, for high frequency treatment Examination on this date showed an extensive ulcerating tumor on the left wall of the bladder covered with blood clots The base of the tumor was considerably infiltrated A clinical diagnosis of carcinoma of bladder was made from the appearance of the growth, and was corroborated by microscopic examination of a portion passed He received three treatments at weekly intervals, and two weeks later a cystoscopic examination showed a dense charred mass covered with phosphatic deposit lying free in the bladder (Fig 11). The tumor was much reduced in size Fig 12 shows the condition of bladder-wall Following this examination the patient suffered from marked hæmaturia and tenesmus, and was confined to bed for a week, during which time he passed a number of large clots After this all symptoms disappeared and he considered himself cured Cystoscopic examination, December 29, 1913,

ALEXANDER A UHLE

showed the tumor to have considerably increased in size, with all appearances of malignancy (Fig 13) Patient has no symptoms, and has gained considerable in weight He is still being treated

In addition to the last case of carcinoma, three other patients with extensive malignant involvement of the bladder were treated, all were markedly cachectic Two patients received two thorough treatments, and one three Bleeding was controlled for a few weeks, in each patient, but a fatal termination took place in all within a few months from the time of the first treatment

A brief analysis of these cases shows that hæmaturia, intermittent or constant, is the most prominent, frequently the only symptom present It is also interesting to note that it was of a terminal type in two cases That hæmaturia, unfortunately, is still regarded as a disease, and not a symptom of some condition, usually a severe one, of some part of the genito-urinary tract, is evidenced by the fact that most of the patients were treated internally for some time, and no attempt was made to definitely locate the cause and site of the hemorrhage The symptomatology is at times misleading, as symptoms may be referred to one organ, when the actual source of disease is another

High frequency destruction of benign growths of the bladder is a very effective method of treatment, even when the bladder is extensively involved Recurrences are frequent after any method of treatment, therefore cystoscopic examinations at stated intervals should be advised in every case of bladder papilloma The immediate effects in malignant growths of the bladder are apparently good, as is shown by the diminution in the size of the growth, and cessation of hemorrhage, but a cure should not be expected, at least, this has been our observation with these few cases

CLINICAL MANIFESTATIONS OF POLYPS OF THE MALE URETHRA*

BY ALEXANDER RANDALL, M D
OF PHILADELPHIA, PA

THE question of the etiology of many of the chronic symptoms that a urologist is confronted with is often quite baffling. One continually finds one's self asking whether or not he understands exactly why he is persevering in a certain form of treatment and only too often the history gives telltale evidence that routine or surmise is the controlling factor. The day of treating in the dark, of feeling for a diagnosis, of deep instillations, and bulbous bougies, is fast fading before the light of visual endoscopic examination. The day of the "seeing eye" is superseding its less accurate, though valuable brother, the "feeling touch."

The subject herein treated is but another link forged to the chain of definite knowledge and pathology which may aid in the obtaining of an exact diagnosis in some of the apparently reasonless cases of chronic symptoms met with in urological work.

When one considers the frequency with which caruncle is found and diagnosed in gynæcological work, one cannot but wonder if a similar and analogous condition does not occur in the male. Yet a survey of the literature on the subject leads to the conclusion that though polypoid proliferation of the male urethra has been described, the frequency of the finding in no way keeps pace with the occurrence of caruncle in the female. While engaged in an active endoscopic clinic it was my opportunity to observe three cases of polyp of the male urethra in the short space of one month, and subsequent close observation soon raised this number, in the space of a little over a year, to nine cases, an analysis of which has appeared elsewhere¹ with especial attention given to their histological structure. I am now able to add five further cases to my experience. That these observations are not unique, I feel sure, for I find no less an authority than Oberlaender making the statement, twenty-five years ago, that he believed that urethral tumors in the male occurred as frequently as bladder

* Read before the Philadelphia Academy of Surgery, February 2, 1914

¹ *Surgery, Gynecology and Obstetrics*, November, 1913, p. 548

tumors, or as caruncle in the female, and blames the apparent discrepancy on the lack of endoscopic study

Etiology—There is little to be said on the cause of such growths. Irritative conditions probably play an important part, as the tissue shows in some cases very active proliferation. The irritant undoubtedly may vary, for though the majority give a history of an antecedent gonorrhœa yet 4 patients denied the previous existence of any acute urethral discharge. That the histological structure varies suggests the possibility that the causes may likewise be of different natures.

Pathology—Microscopic study of these polyps demonstrates that their structure varies markedly. Some are of loose fibrous tissue, with here and there a stray muscle bundle, and with blood-vessels coursing in the long axis of the growth. They are covered with an epithelium in no way differing from the normal mucosa of the urethra. In fact, the structure of this type of polyp is similar to that of the so-called mucous polyps as they occur elsewhere in the body. Others are definitely villous and active proliferation of papillary outgrowths is easily demonstrated. A third group presents the picture of enclosed glandular acini and deep infolding of the mucous membrane. In no case was malignancy suspected or demonstrated. With these findings at hand it was interesting to note that men studying the histology of caruncle in the female were also finding that they had to subdivide them into groups or types, whose histology varied (Williamson and Attlee).

Without troubling you with a close analysis of the pathology and histology of these specimens, nor the reasons why I have chosen so to subdivide them, I will present them classed into three groups, as follows: 1, Benign fibrous polyps, seven cases, 2, benign villous polyps, two cases, 3, benign glandular polyps, five cases.

CASE I—No 1378 Age twenty-nine Admitted April 7, 1912 Denies venereal infection. Complains of a slight discharge, a stinging pain during urination located at the penoscrotal junction, and also under the glans. He has pain at no other time and in no other place. These symptoms have existed for the last three or four years. Glass No 1 and No 2 clear. Bulbous bougie No 27 F detects an "infiltration" at about two and a half inches from the meatus.

July 3, 1912 Patient has been regularly treated, during the last three months with sounds, and has been twice cystoscoped, the bladder being pronounced negative. *Endoscopy* Posterior urethra tender, colliculus is nodular and slightly irregular, walls of the urethra are injected and reddened. Utricle lies gaping in the midline. Silver nitrate application. Anterior urethra at about the suspensory ligament presents a polyp, hanging from the two o'clock aspect of its lumen, it is approximately one and a half centimetres long by one-

half centimetre broad Its walls are smooth Removed with an endoscopic rongeur, 20 per cent silver nitrate solution applied to its place of attachment

July 11, 1912 *Endoscopy* Site of tumor appears œdematous and slightly strictured, probably due to the caustic No apparent growth

July 25, 1912 *Endoscopy* Posterior urethra normal Area in anterior urethra that was cauterized is slightly strictured, due to œdematous mucous membrane

August 30, 1912 Patient has been getting weekly dilatations with sounds and massage of the strictured area *Endoscopy* Posterior urethra normal Site of polyp's growth much better and walls are but little thickened, central point is slit-shaped

September 3, 1912 Glass No 1 and No 2 clear, no discharge, symptoms all gone

Diagnosis—Benign fibrous polyp

CASE II—No 58 Age — Admitted August 12, 1912 History of previous venereal infection not given Trouble of five years' duration Complains of pain at the onset of urination, some pain and discomfort in the perineum and suprapubic region No other urinary symptoms No discharge Never masturbated or passed any blood, no sexual disturbance except nocturnal emissions at least once a week

August 12, 1912 *Endoscopy* Colliculus very tender and three times normal in size, back of the caput on the left superior wall of the urethra at about the two o'clock aspect of the lumen is a polypoid protuberance, white walled and distinct in color from the surrounding engorged urethral mucous membrane It is about 6 mm long and can be moved as if quite pedunculated, yet feels firm and stands outright from the wall Seized with the rongeur and removed with some difficulty because of its toughness Base cauterized with the silver nitrate stick Anterior urethra normal This patient has been lost to subsequent observation

Diagnosis—Benign fibrous polyp

CASE III—No 1144 Age forty-four Admitted December 29, 1912 Has had gonorrhœa several times and now has a profuse discharge again There is frequency and urgency of urination present, but no hæmaturia Glass No 1 and No 2 cloudy Received regular treatment for acute urethritis until the middle of May, at which time he had still a slight morning discharge, but no gonococci were present. Glass No 1 slightly cloudy and glass No 2 clear The prostate was slightly indurated and fixed, with a few adhesions, not enlarged, not tender, prostatic secretion showed a few pus cells No 29 F sound passes to the bladder with ease

May 24, 1912 *Endoscopy* Pendulous urethra normal, bulbus urethra shows marked infiltration and œdema, mucous membrane lustreless and quite thickened (beginning stricture) In the membranous urethra is a small polypoid growth arising from the eight o'clock aspect of the urethral lumen, same was successfully removed with a curette

July 28, 1912 Patient has continued soundings and to-day his urine is quite clear

Diagnosis—Benign fibrous polyp

CASE IV—No 564 Age thirty-one Admitted February 19, 1913 Gonorrhœa five and seven years ago, no venereal sores Complains that since

"strain" two years ago he has a small swelling on the under side of the penis This has not varied in size until three weeks ago, when it seemed to get larger and harder, and at the same time he first noticed a slight discharge Urination was painful and it gave him a stinging sensation before its onset Has seen no blood and has no chordee There is no discharge visible Glass No 1 and No 2 clear Under the urethra is quite a hard nodule the size of a large pea and about one and a half inches from the meatus

Endoscopy In the region of the tumor a nodular swelling arises into the field from the floor of the urethra, the mucous membrane over it is pale and glassy, but not broken at any point Just posterior to this area is a small pedunculated polyp standing upright from the floor of the urethra and about 8 mm in length, it was seized with the rongeur and removed The tumorous mass was twice deeply incised with an endoscopic knife from the urethral aspect, but no fluid was seen to exude

February 28, 1913 *Endoscopy* The nodule is possibly one-third smaller in size on external examination From the urethral aspect the site of the polyp is covered with a lineal scar, while the point of incision into the mass is ragged and slightly ulcerated This patient subsequently developed a para-urethral abscess, that was successfully opened and with its cure all symptoms abated

Diagnosis—Benign fibrous polyp

CASE V—No 1493 Age fifty Admitted May 28, 1912 Has been treated elsewhere for a chronic urethral discharge and a "stricture," for the last two years Complains of a "sensation" in the urethra, a mucoid discharge, and diminished sexual desire *Endoscopy* Posterior urethral walls are engorged Colliculus is irregular and suggestive of some proliferative condition, it is hardly tender to the touch Lightly curetted, and a protargol application Anterior urethra shows signs of old sounding, being sclerosed in places and the lumen cavernous

June 10, 1912 Says that he feels better and that he had an erection last night

Endoscopy Piece removed from the irregular area as it suggests a polypoid proliferation Silver nitrate application to the remainder

June 17, 1912 Since the last treatment the patient has had a most successful coitus, "as of old," he says, with a good strong erection and orgasm *Endoscopy* For the first time the place from which the growth was removed is definitely oriented and the ragged point proven to be about one-half of one cm in front of (distalward to) the colliculus on the floor of the urethra, it was still slightly irregular and was touched with silver nitrate

June 25, 1912 All symptoms gone and the patient reports himself as well *Endoscopy* Area again proven distalward to a slightly sclerosed colliculus and is still rough and crater-shaped, of about 5 x 5 mm in extent Cauterized

Diagnosis—Benign villous polyp

CASE VI—No 27 Age twenty-six Admitted August 1, 1912 Gonorrhoea one year ago Complains of pain suprapubically, slight frequency of urination and a slight glassy discharge from the urethra Urination otherwise normal, sexual power and intercourse normal Glass No 1 and No 2 slightly cloudy Prostate is slightly indurated and very tender in the midline Seminal vesicles negative Prostatic secretion shows about 25 per cent pus cells, also corpora

FIG 1



Specimen removed from Case II. It is a perfect example of benign fibrous polyp, showing the thin epithelial covering the loose connective-tissue stroma and the blood-vessels. The constriction at the base is due to the bite of the rongeur. There is also a small area of round-cell infiltration significant of an infected gland follicle.

FIG 2



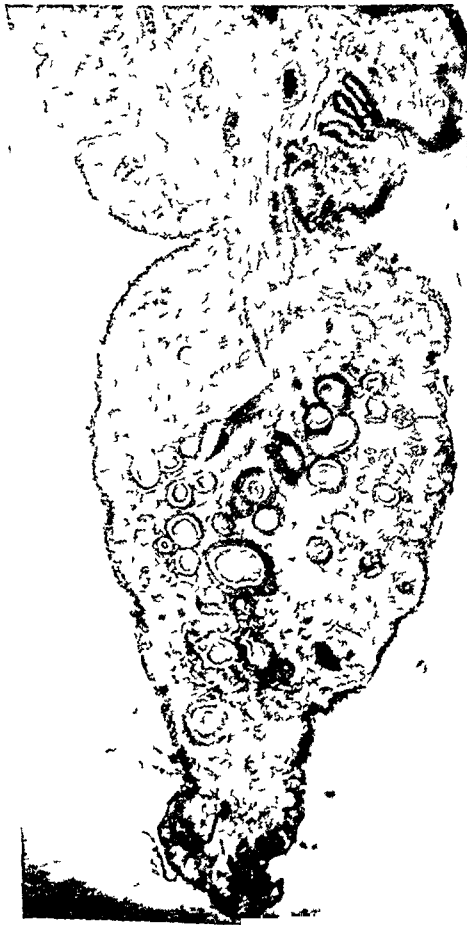
Exempl of benign villous polyp showing rather active papillomatous outgrowths Specimen removed from Case V

FIG 3



The proliferating villi in specimen removed from Case V under high magnification, showing delicate structure and definite papillomatous nature

FIG 4



Specimen of benign glandular polyp removed from Case VII showing a score or more of distended gland acini. The epithelium of the lumen of these glands shows no proliferative tendency. Some of the acini are markedly distended with a clear secretion.

FIG 5



Specimen removed from Case IX showing active glandular hypertrophy with infolding of the walls of the acini. The picture closely simulates that of prostatic hypertrophy though of a much more delicate structure. The black area about the periphery shows the effect and penetration of 20 per cent silver nitrate application.

amylacea and granule cells *Endoscopy* Colliculus enlarged, glary, sodden and lustreless, oedema is marked as is also tenderness Silver nitrate applications. Anterior urethra normal

September 10, 1912 *Endoscopy* Still having pains Colliculus smaller, area about and above the utricular orifice is bilobular and pouting Silver nitrate application

October 1, 1912 *Endoscopy* Posterior urethra about the same, colliculus a little smaller Still having pains Put on bi-weekly prostatic massage

November 12, 1912 Discharge gone, but still having pains

November 26, 1912 Colliculus still bilobular as above noted, appearing like two linked sausages above the utricular orifice Iodine application

January 29, 1913 Patient has been getting prostatic massage fairly regularly, with the subsidence of all symptoms except the pains He states that the only relief that he has had from the pains has been after the urethroscopic application *Endoscopy* The apex of the colliculus appears as above noted, the protuberance completely removed with the endoscopic rongeur

February 5, 1913 Has been free of pain for three days *Endoscopy* Caput is ragged and bleeds easily, but no protuberance visible Silver nitrate application

February 12, 1913 Has been perfectly well and free of all pain for the past week

May 3, 1913 No symptoms present

September 25, 1913 *Endoscopy* Colliculus normal in outline and color No sign of any proliferative growth Patient is practically well though still under observation for chronic prostatitis

Diagnosis—Benign villous polyp

CASE VII²—No 1913 Age twenty-seven Admitted April 30, 1912 Complaints of "impotence" due to premature ejaculation, and poor erections Sexual excitement without gratification during a number of previous years Denies venereal disease Urination is normal Subject to pains across lower back Prostate is quite indurated and adherent, its secretion contains a quantity of pus cells

April 30, 1912 *Endoscopy* On the apex of the colliculus is seen a prominently projecting polyp, standing upright and of fairly firm attachment and structure It is situated a little to the right of the midline, about $\frac{1}{2}$ cm back of the mouth of the utricle, and is approximately 14 x 8 mm in size It was seized with an endoscopic rongeur and removed Its point of attachment was cauterized with a silver nitrate stick The remainder of the urethra is normal

June, 1912 (from a letter) Following the removal of the polyp in this case the patient's pains disappeared entirely, though the sexual symptoms appear to have remained unimproved

Diagnosis—Benign glandular polyp

CASE VIII—No 542 Age thirty Admitted February 10, 1913 Gonorrhoea five years ago with a gradual subsidence of the acute symptoms, but the continuation of a morning discharge to the present day Has occasional fre-

² I am indebted to Dr A B Cecil, now of Los Angeles, Cal, for this case, which he observed while in the service of Dr H H Young, of Baltimore, Md

quency of urination, no pain, no blood Nocturnal emissions always twice a week, often twice per night, and sometimes three or four nights in succession Before he acquired gonorrhœa he would have a pollution once in three weeks, rarely oftener, and one year after the urethritis was contracted he began to have them with increasing frequency until the present time Glass No 1 and No 2 slightly cloudy (phosphates), prostate is small and not adherent, its secretion contains a few pus cells only *Endoscopy* Colliculus is normal in size and contour Posterior urethral walls redden and bleed easily One and a quarter centimetres in front of the colliculus and arising from the five o'clock aspect of the urethral lumen is a mushroom polypoid growth, low-lying and fairly well fixed Excised with a curette and the base cauterized

February 28, 1913 *Endoscopy* Scar where growth was removed is one centimetre in front of the colliculus, the latter is in good condition Anterior urethra is speckled with lenticular-shaped brown spots, especially along the roof of the urethra, they are undoubtedly infected glands, stained from the prolonged use of protargol Some still exude a small droplet of purulent material

March 6, 1913 *Endoscopy* Has not had an emission during the last three weeks, has had no pain except a slight burning during urination On examination, site of excision and the colliculus are normal, slight excretion of prostatic fluid (showing normal elements) into the tube Treatment of chronic anterior urethritis to be continued

Diagnosis—Benign glandular polyp

CASE IX—No 166 Age thirty Admitted September 18, 1912 Denies any venereal disease Complains of a pale, glassy urethral discharge in the morning, of nine months' duration Two months ago he passed some blood at the end of the act of urination Has several preputial warts Prostate is normal on rectal examination and its secretion is normal Glass No 1 contains a few mucoid shreds, No 2 is clear Bulbous bougie detects no stricture in the anterior urethra Cystoscopy attempted but profuse bleeding renders observation impossible

September 24, 1912 *Endoscopy* Anterior urethra is normal Posterior urethra is highly congested and the landmarks are difficult to observe Colliculus does not appear to be enlarged, but everything is intensely engorged and bleeds on the slightest touch Silver nitrate application

September 30, 1912 *Endoscopy* Condition about the same Colliculus appears ragged Silver nitrate application

October 11, 1912 *Endoscopy* After swabbing the posterior urethra with 20 per cent. silver nitrate the landmarks could be made out for the first time What had been taken for the colliculus on previous occasions is a polyp situated about one centimetre distalward from the former, arising from the floor of the urethra in the midline, it is approximately 8 x 6 x 4 mm in size, it was removed with the rongeur and the base not treated External warts fulgurized

October 15, 1912 *Endoscopy* Area from which the growth was removed is slightly oedematous and about one centimetre distalward from the colliculus, it is healing nicely and nothing done to it External warts have vanished

Diagnosis—Benign glandular polyp

CASE X—No 48 Age thirty-four Admitted April 29, 1913 Contracted gonorrhœa ten years ago and has had recurrent attacks of a gleet discharge since Notices shreds in his urine Has recently recovered from an acute

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urethritis during which gonococci were demonstrated (For certain reasons this man may be considered to be either auto-infectious or to receive reinfections from his consort)

April 29, 1913 Smear from urethra shows many organisms, no gonococci
Endoscopy Tube passed after careful irrigation Colliculus twice normal in size, appears sodden and firm, not tender Painted with 20 per cent silver nitrate Anterior urethra show a follicular urethritis Treated

May 5, 1913 No discharge, urine clear except for one mucous shred
Endoscopy Colliculus smaller and can now be entirely seen It is paler and presents a most peculiar appearance The apex is formed by a watery, jelly-like mass of clear translucent tissue, about this mass is a constricting ring of firm tissue, continuous with, and appearing the same as, the mucous membrane of the colliculus This ring or edge can be raised on a probe's point and the whole resembles an acorn in its enclosing jacket I should judge that it is a hypertrophic proliferation inside the utricular orifice and projecting from it

May 12, 1913 *Endoscopy* Same peculiar protuberance from the utricular orifice Rongeur slipped under either lip and the mass removed with two bites It was quite friable and caused but little pain Amount removed measured approximately 10 x 7 x 5 mm. Colliculus cauterized

June 2, 1913 Patient has no discharge, no subjective or objective symptoms Urine clear *Endoscopy* Area about utricle still looks decidedly out of whack, yet I hesitate to do more than to give it a severe cauterization Is to take one month's rest

October 24, 1913 Has been perfectly well to date with the exception that for a few days he noticed a urethral discharge while he was also suffering from a severe cold Urine clear *Endoscopy* Colliculus is pale, slightly sclerosed and no sign whatever of the old growth Utricular orifice is slit-like, entered and washed out

November 11, 1913 No signs or symptoms since last visit No discharge, no abnormality of urination or sexuality Prostate normal

Diagnosis—Benign glandular polyp, showing profuse proliferation

CASE XI—No 81 Age twenty-one Admitted November 12, 1913 Complaints of pains in legs and arms, insomnia, nocturnal emissions Has had gonorrhœa once, the discharge leaving him seven months ago, it was complicated with a right-sided epididymitis For the past months has suffered from a marked feeling of lassitude, and difficulty to keep asleep, waking at about 2 A.M. and tossing about for the remainder of the night Nocturnal pollutions became frequent three to four months ago Now has three or four per week and as often as twice per night, no pain or blood associated with them No discharge from the urethra

November 17, 1913 Urine clear One pollution three nights ago *Endoscopy* Urethra very sensitive and the passage of the instrument is arrested in the posterior urethra The endoscope reveals a thick, dull, engorged and tense colliculus, about four times the normal size Silver nitrate application

November 24, 1913 *Endoscopy* Colliculus less congested, and decreased in size Suggests an intra-utricular growth, but this cannot be definitely made out because of the size Cauterized

December 8, 1913 One pollution in the last week, pains all gone, sleeping better *Endoscopy* Colliculus still larger than normal, dusky and thick look-

ing The intra-utricular growth again observed, it can be pushed back within the utricle, whereupon the lips close and appear as a normal orifice Severely cauterized with the caustic stick

December 17, 1913 Has been free of all pains, sleeping decidedly better, and only one pollution during the last week *Endoscopy* Colliculus still larger than normal and the growth protruding from the utricular orifice Probe can be passed almost entirely around it Alligator forceps carefully placed on either side of the mass, and the same removed in one piece Base cauterized

January 17, 1914 Sleeping practically normally No pains and has had one pollution in the past month

Diagnosis—Benign glandular polyp, showing active proliferation

CASE XII—No 1143 Age thirty Admitted October 28, 1912 Has had gonorrhœa three times without any complications Married In 1910 gradual impairment of sexual power began and for the last nine months has been practically impotent, a slight erection is possible but introitus cannot be accomplished There is a marked prostatitis present, and the prostatic secretion is loaded with pus cells Patient put on a course of prostatic massage, which was persisted in for four months During this time he had a few endoscopic applications of silver nitrate His impotence has been but slightly benefited and on February 4, 1913, he stated that he thought that the urethroscopic cauterization did more good than anything else No discharge from the urethra

February 11, 1913 *Endoscopy* Apex of the colliculus appears practically normal, but back of it and arising from the right side of the verumontanum is a small polyp, about 6 x 3 mm in size It was cauterized

February 18, 1913 Feels better *Endoscopy* Polyp still present and not decreased in size Polyp removed with endoscopic rongeur

March 15, 1913 Urine clear Feels much better Has sexual desire and erections every night and often during the day Better and stronger than in the last two years

April 4, 1913 Sexual power remains good Intercourse can be accomplished, and though somewhat weak, orgasm is present

Diagnosis—Benign fibrous polyp

CASE XIII—No 323 Age sixty-nine Admitted November 25, 1912 This patient entered the hospital at the above date and was found to be suffering with benign hypertrophy of the prostate for which he was operated upon in December, 1912, by suprapubic prostatectomy Since the operation and his complete recovery, he has been complaining of an itching sensation in the perineum, associated with an urgency and slight frequency of urination, having to still get up once per night

January 17, 1914 *Endoscopy* Posterior urethra is quite roomy, its walls are slightly congested Into the lumen of the tube hangs a long thin polyp of at least 1½ cm in length It is attached to the right lateral wall of the prostatic urethra Removed with the rongeur

Diagnosis—Benign fibrous polyp

CASE XIV—No 308 Age thirty-two Admitted November 11, 1912 Complaints of a delay at the onset of urination, which latter requires force to start, stream of poor size and dribbling at the end of the act There is a slight dis-

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charge at times, though patient has never had an acute urethritis. No frequency, no blood. Glass No 1 and No 2 slightly cloudy. Treated for chronic urethritis during December, 1912, and again from July, 1912, until September 24, 1913. *Endoscopy* Posterior urethra back of the colliculus presents a generalized bulbous swelling, this is especially marked about the vesical orifice, condition taken for cystitis colli proliferans oedematosa (Zechmeister and Matzenauer). Iodine application.

October 2, 1913. Urine clear. *Endoscopy* Posterior urethra better, the swelling is glassy and the blebs rounded and tense. There is possibly a polyp on the floor of the urethra between the colliculus and the vesical orifice. Silver nitrate application.

October 15, 1913. Colliculus but slightly larger than normal, on the left of the urethra, back of the apex of the colliculus and arising from the sulcus between it and the urethral wall, is a pale polypoid growth of about 8 x 3 mm in size, it is freely movable. Removed with the rongeur. Silver nitrate application.

November 3, 1913. *Cystoscopy* The internal vesical orifice is encircled by polypoid proliferations lying within the sphincter. These were fulgurized with the high frequency current.

November 10, 1913. *Cystoscopy* Remaining proliferations again treated with the high frequency current.

November 26, 1913. *Endoscopy* Vesical neck appears perfectly clean of all proliferative growths. It is slightly irregular but no polypoid masses.

Diagnosis—Benign fibrous polyp.

Symptomatology—Although presenting these cases divided into three classes according to their pathological structure, it in no way signifies that such groups present differences in the symptoms that they give. There is no grouping of symptoms that may be called pathognomonic of urethral polyp.

Discharge In this series seven patients gave a history of a previous gonorrhœa, four denied having had an acute urethritis, in three the history on this point is lacking. However, nine complained of a chronic discharge, generally of a mucoid nature, in none of which was the gonococcus found. Four were recovering from their first, or a recurrent acute attack, and four claimed that the acute urethritis had gradually subsided and for varying periods of time a gleet discharge had been present. In the patients who complained of no discharge the growth was in the posterior urethra.

Hemorrhage Urethral bleeding was present in but one patient as a spontaneous occurrence, though several of the patients had had bleeding after instrumentation. This is a point that may be emphasized, that spontaneous bleeding is rare, judging from this series of cases.

Pain Various pointed, reflex, and radiating pains, sometimes dull

and at others sharp, some during and others only after urination, the majority presenting vagrancies too numerous to mention, were practically always present. This may be explained on various grounds, but especially must be borne in mind the type of character and the duration of symptoms presented by these chronic invalids. It is significant that two complained of a sensation as though a foreign body were present and one graphically described a thrill which he felt in the anterior urethra during urination. Pain occurring at the onset or the end of urination speaks for a lesion in the posterior urethra, as does also frequency and urgency of urination. But the majority have vague pains, itching or sticking sensations, difficult to locate exactly, but situated at times in the region of the perineum, often suprapubically, rarely as though in the rectum. These rather definite pains are frequently associated with sacral aches, "tired backs," and radiating pains to the hips and thighs.

Sexual Six of these patients complained of abnormalities in their sexual life. Polyps when occurring in the posterior urethra nearly always cause some disturbance in the sexual sphere. This is hardly to be wondered at when one considers the irritation such a condition would excite in the neighborhood of the sensitive verumontanum. This latter structure, supposed to be of erectile tissue, under such an abnormal stimulus would be the point of starting the sexual cycle, so that frequent pollutions, such as presented by one of these cases, where they occurred three or four nights in succession, often twice in one night, and always three times a week, are not strange. The symptom of premature ejaculation similarly may be due to an added irritant sending centripetal stimuli to the ejaculatory centres. Likewise, decreased sexual power, amounting at times to partial impotence, may be accounted for by the inertia following a long period of irritation to the point of exhaustion, not infrequently seen in the latter stages of long standing cases. Of the 6 patients who complained of various sexual symptoms, in every one the growth was in the post-urethra.

Technic—The mode of cure used in these cases has been that of radical removal. In some I tried repeated cauterization with silver nitrate, but it proved inadequate. In others the high frequency current was tried and not only by this means were some beautiful specimens, for microscopic study, destroyed, but it was also found troublesome to control when working in such a small space and often quite painful to the patient.

I prefer to use the plain open (air) straight endoscope of 24 or 26 French calibre, whose sterilization can be simple, rapid and sure, as I

hold that a perfect aseptic technic is very essential to good and prompt results. The removal of the polyp is accomplished by means of either a snare or a delicate alligator rongeur forceps. The snare is a simple one, similar to Blake's nasal snare, I believe, with a shaft made the necessary length, and the instrument slightly more angulated. The alligator forceps is the better instrument to use if possible, and if made slender with biting rongeur blades accurate work, rapid removal, and splendid specimens may be obtained. In the posterior urethra following removal, I nearly always touch the point of attachment with either 20 per cent silver nitrate, or the pure crystal fused on the point of a probe. It is always quite essential thoroughly to dry the area with cotton, after the use of strong caustics, thereby localizing their effect and saving the patient much discomfort. In the anterior urethra experience has taught me to leave the caustics alone, unless very limited effect is obtained by accurate application. In one patient I produced a temporary stricture of the anterior urethra by using a strong solution of silver nitrate too copiously and getting an annular swelling of the mucous membrane.

Conclusions—Chronic symptoms arising from the urethra are practically always due to changes of a very local character in some part of the canal. The appropriate treatment of chronic urethritis depends entirely upon an accurate diagnosis. An accurate diagnosis depends upon a visual examination. The day when Guyon said that a urologist should have his eyes in his finger tips, or better yet at the end of his sound, is passed. The laryngologist no longer treats laryngeal inflammation by only prescribing a gargle. He examines visually, treats locally, and thereby diagnoses accurately. To-day one should no more attempt the treatment of chronic urethral discharge without the endoscope than he would an acute urethritis without a microscope. The subject of urethral polyp is but one of the things, one of the entities, that we have sifted out of a long line of symptoms, generally so vague, so obscure, scattered yet closely associated, individually often unimportant yet collectively oftentimes leading the patient to a very bitter existence, and the bright spot is, that it is easily and completely remedied by appropriate treatment.

A METHOD OF TREATING ADHERENT PERFORATING ULCER OF THE POSTERIOR WALL AND LESSER CURVATURE OF THE STOMACH

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THERE is perhaps no condition among the benign lesions of the stomach that is more difficult to treat surgically than the large bleeding ulcer of the posterior wall or lesser curvature which has become the centre of an inflammatory mass, and has formed adhesions with, or has even perforated into the tissues of neighboring organs, particularly of the pancreas. And especially difficult are these cases when the ulcer is situated some distance away from the pylorus and well up underneath the arch of the left floating ribs. The resection of a complete transverse slice of the stomach as advocated by Bier is in such cases more than usually difficult, and far from safe. Even the excision of the ulcer after the plan advised by W J Mayo, who separates the posterior adhesions and pushes the whole ulcer-bearing area forward through an opening made in the anterior wall of the stomach, there to be conveniently and with comparative safety excised—even this would be, in the type of case just described, decidedly difficult. If in addition one has to do with a patient who has become somewhat anæmic through repeated hemorrhages, and who is generally much reduced by prolonged half-starvation, the risks of any radical operation are most seriously increased. Under these circumstances it has been the custom of many to perform a gastro-enterostomy, posteriorly if the adhesions allow it, anteriorly if they do not, and to trust for the cure of the ulcer to a presumed improvement in the evacuation of the stomach, and to the chance of a good effect being brought about by the reflux of the alkaline duodenal juices into the stomach. We are now all familiar with the views of Paterson (of London) who claims that the operation of gastro-enterostomy is chiefly a physiological one, and accomplishes its good results by this very reflux of alkaline juices which neutralize the excess of acid in the stomach supposed to be so frequently present. Without, at this time, expressing an opinion concerning the correctness of Paterson's views, it may, I think be doubted whether a simple gastro-enterostomy can with any frequency relieve the very serious condition which alone is here in question. It is true that some patients have been much benefited by such a procedure whether with or without exclusion

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of the pylorus, but it may reasonably be assumed that gastro-enterostomy alone more often than not fails to cure such cases as these.

The principle of exclusion of the pylorus as a complementary operation to that of gastro-enterostomy, with the object of protecting a pyloric or duodenal ulcer, is now generally accepted. Paterson, so far as I know, is the only prominent surgeon (always excepting Sir Arbuthnot Lane) who denies the need, or even the desirability of doing it. I have carried out this operation by means of a fascial ligature taken from the anterior sheath of the rectus, according to the method ascribed both to Bogoljuboff and Wilms, in seven patients, and (with Dr Scrimger) in over a score of animals, and up to the present with very satisfactory results. Consequently, when in July, 1913, a case of the type above described came under my care, and I found that excision was practically out of the question, and that a posterior gastro-enterostomy was impossible on account of adhesions, I was the more inclined to accept the idea which suggested itself to me during operation, and carry out an exclusion of the ulcer-bearing area by tying off the stomach above the ulcer with a fascial ligature.

The history of the case was briefly as follows.

CASE No. 24357—Mrs M S, admitted July 2, 1913, age forty-four.

Complaints—Vomiting, pain in stomach, and weakness.

Present Illness—About three years ago (January, 1911) the patient began to suffer from sharp pain in the back running up to the shoulders, with eructations of gas coming on three or four hours after food. In July, 1911, nausea and vomiting appeared. Pain was relieved by vomiting, but not by the taking of food. She never noticed blood either in the vomitus or in her stools. During the fall of 1911 she took treatment in Montreal and was much improved. In March, 1912, her symptoms recurred, and lasted on and off till January, 1913. During February and March, 1913, she was slightly better, but grew worse again about the end of March, since which time up to the present there has been more or less persistent vomiting of large quantities of fluid, frequently blood-stained, at times the vomitus consisted of pure blood. Since March the patient has lost thirty pounds.

Present Condition—A rather thin woman, somewhat anæmic, and clearly much reduced in weight and strength.

Palpation reveals tenderness of the entire upper abdomen, but the point of maximum pain and soreness is two inches below the xiphoid in the midline. No definite mass can be felt. Both recti are resistant, the left more so than the right.

Test breakfast total quantity withdrawn 20 c c , total acidity 59, free acid 38, no lactic acid, strong positive reaction for occult blood The stools were tarry

A bismuth meal demonstrated very clearly a large perforating ulcer near the lesser curvature, with typical deposition of bismuth in the ulcer, and overlying gas bubble The diagnosis of gastric ulcer was sufficiently evident

Operation (July 8, 1913) —Gas-ether anæsthesia Incision in midline between the ensiform cartilage and umbilicus On the posterior wall of the stomach was found a large indurated mass about the size of a hen's egg, the upper limit of which involved the lesser curvature It was situated (as was later demonstrated) 7 cm from the diaphragm on the lesser curvature, and 9 cm from the pylorus It was densely adherent to the pancreas That it was a perforating ulcer we already knew It was found impossible to do a posterior gastro-enterostomy on account of adhesions There were no adhesions to the liver or to the abdominal wall The inflammatory mass was situated under the left costal arch, and it would have been almost impossible to expose it sufficiently for the purpose of resection without mobilizing the lower thorax on that side

Under these circumstances the operation of resecting the ulcer-bearing area in a patient whose resistance had been seriously reduced by bleeding and insufficient nutrition seemed to be almost too formidable to undertake with any justification Apparently the only thing to do was an anterior gastro-enterostomy In the presence, however, of an active bleeding ulcer with extensive inflammatory infiltration around it, and perforating presumably into the pancreas, it seemed rather hopeless to expect that a simple gastro-enterostomy could accomplish anything worth while It was felt that the ulcer needed protection Accordingly the idea of excluding the ulcer by means of a fascial ligature, which occurred to the writer at the moment, seemed to afford the easiest way out of the difficulty I am unaware that any greater part of the stomach than the pylorus, or the antrum pylori has ever been excluded in this way before, but from experience in animal work in which Dr Scrimger and myself have found that the exclusion of the whole peristaltic portion of the stomach is quite well tolerated, it seemed not unreasonable to think that the result in the human might be good

Accordingly, a fascial strip taken from the anterior sheath of the rectus was passed by means of a long curved forceps through a slit in the great omentum, close to the greater curvature behind

the stomach, and out through an opening in the lesser omentum close to the lesser curvature, about one cm above the upper limit of the inflammatory mass. On tightening the ligature and securing it with a few silk stitches, the stomach was found to be tied off about its middle, forming an artificial hour-glass stomach. Thereupon an anterior gastro-enterostomy was performed in the cardiac half of the stomach at a point on the jejunum about 12 inches from the duodeno-jejunal juncture. The stoma was about 2 inches above the greater curvature, about a third of the way from the greater to the lesser curvature. The abdomen was closed without drainage.

The patient's general condition was good from the second day of operation on. From July 8 to July 26 she was free of pain and of vomiting. She took liquid food well, and toward the end of this period began to take some solid nourishment, even a little meat. On July 27 she began to complain again of abdominal discomfort which, during the next few days, increased to pain. Shortly, she began to vomit again, and on August 19 blood was discovered in the vomitus. The stools also, on this date, were tarry. Pain, vomiting and bleeding continued at short intervals from this time on.

A bismuth meal during the last week in August appeared to demonstrate that the fascial ligature had held, and that food was leaving the stomach to a certain extent. After four hours, however, a trace of the bismuth was to be seen at a point toward the pyloric side of the ligature, and it was thought that the ulcer must have burrowed through and established some slight communication with the cardiac half of the stomach. It became clear at post-mortem that this must have been a slight overflow of the bismuth through the opening afforded by a partial yielding of the fascial ligature. The X-ray also showed that there was retention of a considerable proportion of the bismuth in the stomach after twenty-four hours.

In view of the persistence of symptoms, and the progressive loss of weight and strength of the patient, it was felt by Dr Martin who saw the case in consultation, and by myself, that it was necessary to reopen the abdomen and either pass a second fascial ligature around the stomach higher up, or else add a second gastro-enterostomy in order to improve stomach evacuation, according as the conditions found might indicate.

On August 28, therefore, the abdomen was reopened through the old scar. There were extensive adhesions of the wall of the stomach and the jejunal loop, together with the gastrocolic and gastrohepatic omenta to the anterior abdominal wall. These were all freed, though with some difficulty. It was then found

that the anastomosis was patent for two fingers at least, that the band of fascia was apparently holding so far as one could see from the indrawing of the greater curvature, although no attempt was made to pass the finger through the artificial hour-glass constriction, and that the distal portion of the stomach was slightly distended, although not abnormally so. The area of the ulcer was about as before. It was buried in adhesions high up under the ribs, and the cardiac portion of the stomach seemed to bulge over toward the midline so as partly to cover the ulcer area. It was impossible to tell whether the ulcer had burrowed its way into the proximal part of the stomach or not, but if so, it could only be by a very small communication. It appeared to be impossible to pass another fascial ligature above the former one, but in any case this seemed hardly to be indicated, as the first ligature had apparently held, although later it was found that this was not the case. Accordingly it was decided to do a second gastro-enterostomy as near the greater curvature as possible. Owing to the difficulty of pulling the stomach forward from under the ribs, it was impossible to get a stoma of more than $1\frac{1}{4}$ to $1\frac{1}{2}$ inches.

This operation, which she stood well, quite failed to relieve her pain or vomiting, and she went steadily down hill, vomiting several times a day, and occasionally vomiting a good deal of blood—sometimes pure blood.

On September 5 a jejunostomy was done under local anæsthesia, for the purpose of feeding. In the evening after the operation she had a large hæmatemesis. This was repeated on the second day following, and on September 7 she died of inanition and hemorrhage.

The post-mortem revealed an interesting condition. There was no evidence of peritonitis, nor any fluid in the abdomen. The ulcer was of large size, almost quite round, had very thickened walls, and over its floor coursed a large vessel in which was found an opening large enough to admit a small probe. Clearly it was from this point that the repeated hemorrhages had come. Altered blood lay in the duodenum, in the upper part of the jejunum, and also in the upper part of the large intestine. The gastro-enterostomy openings were healed and patent.

It was found that the fascial ligature had yielded to the extent of admitting the tips of three fingers in the opening joining the cardiac with the pyloric portions. The ulcer measured 5 cm in both diameters, and the tissues of the stomach wall were thickened to the extent of about $1\frac{1}{2}$ cm. The wall was perforated at the base of the ulcer, and the bed was formed by the surface of the pancreas. The pancreatic substance itself was, contrary to expect-

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tation, not invaded The small artery already mentioned, with its perforation, clearly made it difficult to hope for cure. Under the circumstances direct ligature alone could have accomplished anything worth while.

The cardiac half of the stomach showed a pouching below the two gastro-enterostomy openings, somewhat analogous to the pouching of the bladder behind an enlarged prostate, and this clearly accounted in part for the retention of the stomach contents In this fact I find an argument against the placing of the gastro-enterostomy opening in the cardiac portion of the stomach in which peristalsis is absent, or at least in favor of placing it strictly at the most dependent point of the stomach, if one is obliged to use the cardiac portion for this purpose

Although the result in the present instance of the procedure of tying a fascial ligature around the body of the stomach failed to save the patient, I can hardly think that the method in itself was to blame The presence of the bleeding ulcer, and the giving way of the fascial ligature (which, it may be mentioned parenthetically, is the only time it has done so in a series of five human cases and a considerable number in animals) combined to spoil the ultimate result, but the immediate effect of the operation and the improvement for the first three weeks were decidedly encouraging It still seems justifiable to propose the operation for all such ulcers of the posterior wall and lesser curvature as are mechanically difficult to excise and where excision seems at all risky Particularly will this be the case when the ulcer is a perforating one, when there is much inflammatory tissue around it, when the patient is much reduced from hemorrhages and chronic starvation, and when the ulcer is situated somewhat inaccessibly under the left floating ribs

NOTE —Last summer while in Germany I suggested to my friend, Prof Anschutz, of Kiel, the method herein described, of treating gastric ulcers, and he adopted the idea with some enthusiasm In a late number of the *Centralblatt für Chirurgie*, (February 14, 1914) Prof Baum, Oberarzt of the Kiel Clinic, gives a short résumé of five cases in which he carried out this procedure The results were extremely good, although sufficient time had not elapsed to show whether healing was permanent or not

CONGENITAL PYLORIC STENOSIS

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ALTHOUGH much has been written on the subject of congenital pyloric stenosis, but little evidence has been brought forward of the change that takes place in the pylorus itself after medical or surgical treatment

The following case, having died seven months after operative treatment from an intercurrent condition, gave on post-mortem examination evidence of value as regards the pathology of the disease

History of the Case—A C, a male, aged two months, was admitted to the medical side of the London hospital on February 6, 1913, suffering from wasting and vomiting. He was the only child and his parents described him as being always delicate, but there was no family history of any similar condition. Pregnancy and parturition were normal. For the first fourteen days he was fed naturally, but after this the mother's milk failed and he was then fed with diluted condensed milk. Within two days of starting the new food he commenced to vomit, and the diet was then changed to diluted cow's milk. The vomiting continued and became projectile in character, the child remaining small and wasted. Constipation was marked. Medical treatment was tried for a fortnight, but during this time vomiting continued, in spite of frequent small feeds and stomach washes, and the child lost half a pound in weight. He was then transferred to my service on February 20, 1913. At that time he was markedly thin and wasted, and weighed only five pounds, resembling a premature child rather than one of two months of age. Any food administered was forcibly vomited, there was visible peristalsis in the abdomen passing from left to right, and at times an ill-defined tumor could be felt in the position of the pylorus. Operation was decided upon, chloroform and ether anæsthesia being used.

A vertical incision was made through the right rectus, a posterior gastro-enterostomy being performed. The small intestine was of the size of an average lead pencil so that some difficulty was experienced in making a neat junction. The opening was made so as to lie vertically and as close to the pylorus as possible, the opening being one and a half inches in length. The junction



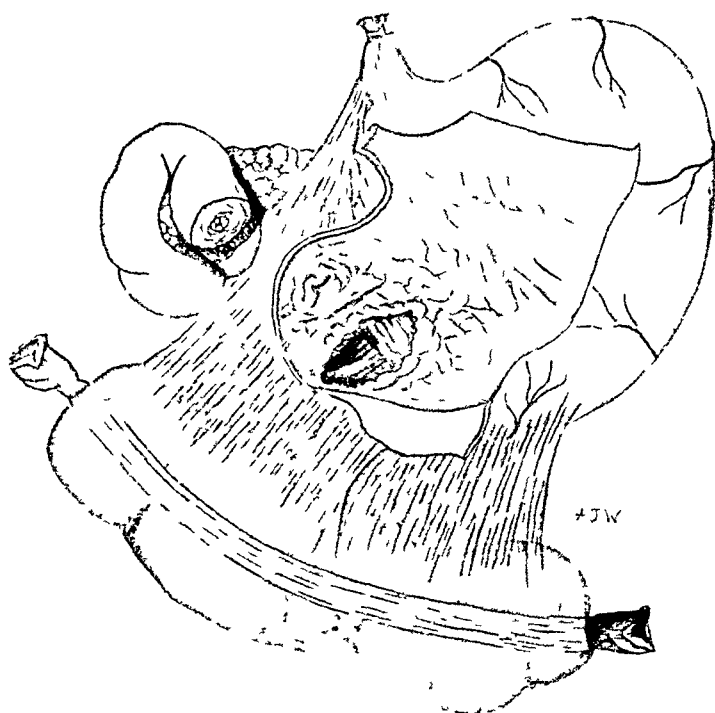
Anterior aspect of unopened stomach showing appearance of pylorus

FIG 2



Posterior surface of stomach, showing gastrojejunostomy

FIG 3



Anterior aspect of opened stomach showing condition of pylorus and gastrojejunostomy opening

was made in the usual way with four sutures with the aid of clamps. The edges of the mesocolon were sutured to the junction and the abdominal wall was closed, the operation occupying twelve minutes. Before closing the peritoneum three ounces of sterilized saline were poured into the cavity.

The patient stood the operation well and showed no evidence of shock. On returning to the ward rectal salines, half an ounce hourly, were instituted, diluted peptomized milk being also given by mouth in small quantities. The amount was gradually increased until the normal quantity was administered. Vomiting ceased from the time of operation and the patient steadily improved. At the time of discharge on March 23, 1913, he appeared to be a healthy baby and had completely lost the shrunken appearance. In a month since the operation, he gained 2 pounds 10 ounces, weighing 7 pounds 10 ounces at that time. There was no return of the vomiting and the child was taking his food well and the bowels were opened regularly. Peristalsis was no longer visible in the upper abdomen. After leaving hospital the child continued to progress favorably and each month had gained considerably in weight. On the first of June his weight was 13 pounds 6 ounces and he appeared in every way a normal child. On September 26, the mother brought the child to hospital, as there had been a return of vomiting associated with diarrhoea. He was seen and admitted to the medical side as a case of epidemic diarrhoea and vomiting. Until two days before re-admission he had remained perfectly well. In spite of careful medical treatment the child died with the typical symptoms of epidemic diarrhoea and vomiting on September 30, 1913, that is, seven months after operation.

Post-mortem Appearances—Examination of the abdomen was alone permitted. There was a three and a half inch vertical scar in the epigastrium half an inch to the right of the midline. This was well healed and there was no sign of ventral hernia. The peritoneal cavity was free from adhesions while the viscera were in their undisturbed conditions. The stomach was not dilated. The pylorus, however, was felt to be markedly hard and thickened, forming a tumor-like mass three-quarters of an inch in length (Fig 1). On lifting up the stomach the junction between the jejunum and stomach was seen. The mesocolon was adherent to the line of the junction and in this position were several membranous adhesions running from the mesocolon to the jejunum (Fig 2). The stomach, duodenum, and pancreas, together with the upper portion of the jejunum, and part of the transverse colon were removed *en masse*. Before opening the stomach the œsophagus and jejunum were ligatured and it was then found that the pylorus was impervious to the passage of fluid, but there was a free passage through the gastro-enterostomy opening which was

the mucous coat From the gastric aspect the cavity of the stomach is seen to gradually taper until the constricted lumen is reached On the duodenal side, however, the transition is sudden and the thickened muscular coat projects forward into the lumen of the duodenum so as to give an appearance which has often been likened to that of the cervix uteri The stomach itself is dilated and its walls are hypertrophied, but this hypertrophy does not pass gradually into the thickening of the pylorus, so that it appears to be not an extension of the latter condition but a simple hypertrophy such as may be found with any form of pyloric obstruction It is, however, most marked in the pyloric antrum and less in the cardiac portion Hutchison²⁷ states that occasionally the lower end of the œsophagus may also be hypertrophied As regards the nature of the thickening of the pyloric wall, this has been found to be due to an enormous overgrowth of the muscle coats Bunts⁵ regards the condition as being due to pure hypertrophy of the muscular fibres, but Hipsley²⁵ asserts that the condition is not one of simple hypertrophy for not only is there an increase of fibrous tissue as well as muscle but between the circular fibres are bundles of muscle running in varying directions The majority of observers are, however, in favor of the condition being due to a pure muscular hypertrophy Three main views have been held as to the cause of this hypertrophy (1) That it is due to congenital malformation, (2) that it is due to spasm of the muscle, the long continued spasm being followed by hypertrophy, (3) that it is due to incoordination between the movements of the stomach and pyloric walls

Hutchison,²⁷ in his masterly review of the subject, considers the evidence in favor of these three views As he points out, the facts—that the symptoms are not present at birth—that these children do not as a rule show other congenital malformations—and that there is no relaxation of the hypertrophied muscle—are against a congenital origin To this might be added the fact that it is quite exceptional to find a family history of the disease, although such a history is common with other congenital malformations In spite of these facts Cautley⁹ regards the condition as a congenital overgrowth and believes that in the attempt to secure an efficient pylorus nature has produced too great a quantity of muscular tissue

In favor of spasm is the fact that the condition comes on more commonly some two or three weeks after birth and such a spasm would account not only for the hypertrophy of the pyloric muscle, but also for the partial or complete occlusion of the pyloric canal, and since, as will be shown later, many of the cases are, in their early stages at least,

relieved if not permanently cured by medical treatment, it is necessary to believe that the pylorus can dilate as could happen if the occlusion were due to simple spasm. The condition in fact may be regarded as analogous with the so-called cardiospasm and possibly with idiopathic dilatation of the colon. Since, moreover, the condition is more common when a change is made from maternal to artificial food, a factor is present which might be sufficient to give rise to the spasm. Even if the condition be due to this spasm it would be necessary to discover the cause of the spasm. In none of the reported cases has any definite abrasion or ulceration been described and in none of the cases in our pathological department have I been able to distinguish any such lesion. It is possible, however, that such a spasm might be excited either by some lesion remote, or even by some change in the gastric contents. All surgeons are conversant with the marked temporary spasm of the pylorus which is so often seen at operation in some cases of duodenal ulcer or even appendix dyspepsia, and in this condition both Engel¹⁷ and Pfaundler⁴⁰ describe a hyperacidity of the stomach contents. Miller and Wilcox,³⁷ however, deny the presence of any hyperacidity, and the work of Feer¹⁸ showing that the hyperacidity is the result, and not the cause, of pyloric obstruction, together with the experiments of Cameron⁷ showing that, even if such hyperacidity does exist, acid on the gastric side of the pylorus relaxes rather than contracts the sphincter, would seem to negative this suggestion. Shattock,⁴⁷ in his able article on the idiopathic dilatations in general, inclines to the belief that the spasm is secondary to a hyperæsthetic condition of the pyloric mucosa, so that even the passage of the normal stomach contents is sufficient to set up the spasm. Even if the presence of such a spasm is the preliminary cause of the hypertrophy the present case would seem to show that when once the condition is firmly established even complete relief of any possible irritation as occurs after gastro-enterostomy is not sufficient to allow the condition to abate. The condition has, in fact, become something more than pure spasm. As regards the last view that the condition is due to incoordination between the movements of contraction of the stomach and of relaxation of the pylorus, although this view is supported by Thomson⁵² who states that the condition might commence in intra-uterine life, but little evidence can be brought forward either in support or in opposition to it. If the condition is regarded as analogous with cardiospasm, idiopathic dilatation of the colon, and the condition Shattock described as idiopathic dilatation of the bladder, then such a theory would satisfactorily explain all these conditions and at the same time would make the temporary relaxa-

tions which appear to occur possible. On the whole, however, present evidence is in favor of the condition being due to a primary spasm which later is followed by pure hypertrophy of the muscle coat, which hypertrophy when once fully established not only permanently occludes the lumen but is unlikely to fall into abeyance.

Symptoms—As mentioned previously all are agreed that the symptoms rarely commence at birth. Garrod²² gives the date of onset as varying from the first to the fifth week and in 4 of Still's⁵⁰ 20 cases the symptoms commenced within the first week of life. In my own case the symptoms first showed themselves between the second and third weeks of life, the onset being associated with change from maternal to artificial food. As a general rule the first symptom is vomiting. In the earlier stages this is slight in amount and follows each meal, being mistaken for simple regurgitation and thus may lead to a change in the variety of food given. Such changes are not uncommonly followed by temporary relief and thus it is that the dietetic treatment is continued on inadequate lines until the disease is well established. In the course of time, vomiting becomes more marked and larger in quantity until, perhaps, the whole of the food is returned. Not only do the quantity and frequency of the vomit increase but one of the most characteristic symptoms is the force in which it is ejected. For this reason the condition is described as projectile vomiting and the mother will state that the food is brought up not only without much apparent effort but that it is ejected for a considerable distance or, as the mother puts it, it is pumped up with great force. At this time there is other evidence of the failure of the food to pass the pylorus. The child becomes constipated and soon begins to waste. The body has a shrunken and wizened appearance so that the eyes are shrunken and the skin hangs in folds. Weight is rapidly lost, and, as in the case here described, the child may at the age of two months weigh less than it did at birth. On examination the upper abdomen may be seen markedly distended, and on palpation, or the administration of food, visible peristalsis may be elicited. This has all the characteristics of stomach peristalsis. It is seen in the upper abdomen and passes from left to right and during contraction the outline of the stomach may be easily seen and felt. The lower border of the stomach not uncommonly reaches the umbilicus. In the more advanced cases it is possible to make out a definite tumor in the region of the pylorus. This tumor, which is formed by the hypertrophied pyloric wall, is situated to the right of the dilated stomach and is freely movable. At times it may be seen to vary in constancy, being most marked when the muscle is apparently contracted. The frequency

of this sign is variable, but Marsh ³² states that he was able to feel the pylorus in four out of his six cases

As regards the condition in adults, Russell ⁴³ has shown that there is in the majority of cases a long history of symptoms. There will be indefinite attacks of stomach trouble or digestive difficulties so that the patient will have to exercise care in the choice of his diet. In some cases the symptoms tend to be slight and constant rather than occurring in definite attacks, but even if the symptoms are constant any excess of food is likely to be followed by attacks of either more severe dyspepsia or what the patient describes as bilious attacks. On more careful investigation it may be found that the symptoms are rather those of gastric dilatation, and as time goes on the attacks become not only more severe but more frequent. In his cases examination showed evidence of dilatation, peristalsis perhaps being present. He states that spasm of the pylorus may be felt. In spite, however, of these symptoms and the course of the condition, he advocates medical before surgical treatment. He states that when this method is no longer sufficient to enable the patient to nourish himself he should be advised to submit himself to operation. Since, however, all his cases were diagnosed on operation, and since also the symptoms are usually progressive, there seems little to be gained by putting off the operative treatment.

In the diagnosis of the condition as it appears in infants, but little difficulty will be experienced. The forcible and projectile vomiting, the marked wasting in spite of the most careful dieting, and the obstinate constipation will make the diagnosis clear. In more advanced cases the visible peristalsis, and the dilatation of the stomach with the possible presence of tumor will prevent any possibility of doubt. Nevertheless, Pisek and Le Wald ⁴¹ advocated the use of X-rays after the administration of bismuth. They state that in normal infants the food is passed into the duodenum a minute or two after its ingestion. Such a method can only be of use in the very early stages. Unfortunately so many cases when sent to hospital are moribund and a large proportion of those entering the London Hospital have died within thirty-six hours of admission, being far beyond the hope of medical or surgical treatment. In the later cases occurring in adults it is unlikely, unless there is a definite history of the presence of the condition during infancy, that accurate diagnosis can be made. The symptoms are more likely to suggest an organic lesion following a chronic gastric ulcer, for as Maylard ^{33,34} has pointed out they are extremely diverse and in all probability the diagnosis will only be made at operation.

Prognosis and Treatment—All are agreed that without treatment

the condition is steadily progressive, but very much discussion has arisen as to whether the treatment carried out should be medical or surgical. In favor of medical treatment, Hutchison²⁷ states that he has seen 20 cases in private practice, 17 of which treated at home have recovered, and he definitely states that all of these cases exhibited the classical features of congenital pyloric stenosis in a pronounced degree and hence there is no doubt that they were this condition and not a simple one of temporary muscular spasm. He states, however, that at the Children's Hospital where medical treatment was alone adopted there was a 78 per cent. mortality in 64 cases, which he believes is due to the fact that at hospital they are seen at a later stage. He believes that, regarding the ultimate results of medical treatment, in some cases, at least, the cure is both complete and permanent and mentions cases examined five years after treatment with no return of symptoms. In one case, however, there was still dilatation of the stomach three years after apparent recovery, and he suggests that some of the cases already described which were recorded by Russell and Maylard may perhaps have originated in this way, and it is of interest here to note that Barling¹ has described two cases of the ages of twenty-seven and seventeen years respectively, which showed the characteristic appearance of the congenital type of lesion and thus were quite distinct from those reported by Maylard.

Pearse³⁰ has reported a case in a child one month old which was cured by medical treatment and which had been followed up for a year after treatment and had remained cured. Still⁵¹ also writing in support of medical treatment states that excluding three cases treated before the modern methods came into vogue, and 3 further cases which were lost sight of, there were 19 recoveries out of 36 cases, that is, a mortality of 47 per cent.

Heubner,²⁴ Starck,⁴⁰ Bloch,⁴ and Bendix³ have between them reported 71 cases treated on medical lines, of which 66 recovered. These latter figures would seem to be greatly in support of medical treatment, but when the subject is viewed from the surgical aspect they are equally startling. The cases, to the figures of which I have personally had access, total 23 in all. Nineteen were treated by medical means alone, of these 18 died, whereas 4 were treated by surgical means with 2 recoveries. It is perfectly true that all these cases were hospital patients, and hence, as Hutchison has pointed out, one would expect in them a high mortality from medical treatment. Scudder⁴⁵ also states that in his experience the mortality in medical treatment is between 80 and 90 per cent and what is more important quotes the end results of some

so-called medical cures Of three such cases, one at the age of two and a half years was rhachitic dwarf, weighing $21\frac{3}{4}$ pounds, a second grown to childhood is vomiting all solid food, while a third at the age of six years lives entirely on fluids He says that as far as he is able to determine no true tumor has yet been cured by medical treatment and no so-called medically cured case has ever been proved to have had the disease He also quotes the case reported by Morse, Murphy and Wohlbach where the tumor was found at autopsy six and a half months after successful gastro-enterostomy This case, together with the one I report here, certainly seems to show that in spite of perfect rest obtained by operation there is no tendency for the tumor to improve

As regards the results from surgical treatment Scudder has collected together 33 cases, 14 of them being his own, 3 only of which died In addition to this last many small series have been published, the results of which have been very variable, thus, Downes¹⁶ has published 2 cases, both treated by gastro-enterostomy and both successful Bunts⁵ reports 7 cases, 3 of which died, all of them being treated by an anterior gastro-enterostomy Nicoll³⁸ gives a series of 3 successful cases, 2 being treated by posterior gastro-enterostomy and 1 by pyloroplasty He also quotes a further series of 6 cases on which he performed pyloroplasty Of these cases 1 died and 5 were cured Burghard⁶ has had 11 recoveries out of 16 cases Lendon³⁰ reports 8 Australian cases of which 6 died Thomson⁵³ gives the mortality as 15 out of 23 cases, but he admits what is perhaps one of the most important points, that in so many of these cases operative treatment is sought only as a last resource Cautley¹⁰ has also emphasized this point and gives a series of 6 recoveries out of 7 cases in private, but a mortality of 4 out of 5 in hospital cases Later, in a paper with Dent,¹¹ he advocates pyloroplasty and records 50 per cent of recoveries Grenet, Veau and Sedillot²³ report a case successfully operated on at the age of two months

A very important series is that published by Fredet and Tixier²⁰ in so far as they show the after-results of operative treatment One child operated on at the age of two months is now five and a half years old and in excellent health A second case had pyloroplasty performed at the age of thirty days and now at the age of five and a quarter years is in perfect health In a second paper²¹ they reported a case operated upon at the thirteenth day of age, a posterior gastro-enterostomy being performed A vicious circle appeared and necessitated lateral anastomosis At the time of the report the child was one hundred and nine

CONGENITAL PYLORIC STENOSIS

- ²³ Grenet, Veau, and Sedillot *Cliniques enfants*, 1913, 11, p 197
- ²⁴ Heubner *Therapie der Gegenwart*, October, 1913
- ²⁵ Hipsley, P L *Austral Med Gaz*, 1912, p 253
- ²⁶ Hirschsprung *Jahrb d Kinderheilk*, 28, 1888, p 62
- ²⁷ Hutchison, R B M J, October 8, 1910, p 1021
- ²⁸ Ibrahim *Die angeborene pylorusstenose*, Berlin (Karger), 1905
- ²⁹ Landerer *Ueber angeborene Stenose des Pylorus*, Tubingen, 1879
- ³⁰ Lendon, A A *Austr Med Gaz*, 1912, p 521
- ³¹ Marie *Virchow's Archiv*, 185, Bd cii, S 413
- ³² Marsh *Liverp Med Chir Jnl*, 1911, p 104
- ³³ Maylard, A E B M J, vol 1, 1904, p 417
- ³⁴ Maylard, A E B M J, July 11, 1908, p 71
- ³⁵ Maylard, A E *Lancet*, May 11, 1911, p 1194
- ³⁶ Mayo Robson *Med Annual*, 1907, p 534
- ³⁷ Miller and Wilcox *Lancet*, December 14, 1907
- ³⁸ Nicoll, J H *Practitioner*, November, 1910, p 659
- ³⁹ Pearse B M J, October 30, 1909, p 1280
- ⁴⁰ Pfaundler *Jahrb der Kinderheilk*, 70, 1909, p 253
- ⁴¹ Pisek and Le Wald *Archives of Pediatrics*, 1912, xxix, p 911
- ⁴² Rammstadt *Med Klinik*, 1912, viii, p 1402
- ⁴³ Russell, W B M J, July 11, 1908, p 68
- ⁴⁴ Sarvnot *Rétreciss du pylore*, Paris, 1905
- ⁴⁵ Scudder, C L *Surg Gyn and Obstets*, April, 1912, p 373
- ⁴⁶ Scudder, C L *Boston Med and Surg Jnl*, September 15, 1910
- ⁴⁷ Shattock, S G *Proc Roy Soc Med*, 2, Sect of Path, p 88
- ⁴⁸ Sherren, J *Choyce's System of Surg*, vol 2, p 408
- ⁴⁹ Starck *Zentralbl fur Kinderheilk*, 14, No 5, 1909
- ⁵⁰ Still, G F *Lancet*, March 11, 1905
- ⁵¹ Still, G F *Common Disorders and Diseases of Childhood*, 1909
- ⁵² Thomson B M J, 2, 1908, p 678
- ⁵³ Thomson *Clin Exam and Treatment of Sick Children*, 2nd ed

days old and perfectly recovered On the other hand, Sarvnot ⁴⁴ has collected 23 recorded operations with death in 13 and recurrence in 10

From these figures it is difficult at first sight to determine whether medical or surgical treatment should be adopted The series of successful cases following medical treatment cannot be overlooked and there is no doubt that even if the cases of recurrence are excluded there still remains a large number which are cured by medical treatment On the other hand, it must be admitted that many such cases do die as the result of medical treatment alone, whereas, surgical intervention has been very successful It must also be remembered that the surgical statistics appear to give bad results very often owing to the fact that operative intervention is often only sought when the child is moribund It would seem, then, that there are a certain number of cases which should be treated by medical means but that there are other cases in which surgical intervention alone holds out any hope of success The difficulty is to determine which cases fall into either category

As already mentioned, Scudder has stated that he has never known a case in which a tumor being definitely present recovered from medical treatment, and he has also pointed out that X-ray examination after posterior gastro-enterostomy shows that no food passes the pylorus That the condition may show no improvement as regards the stenosis is, I think, definitely proved by the case I have reported above, for here, in spite of perfect rest, which no medical treatment could hope to emulate, the obstruction of the pylorus persisted and there was not the slightest evidence of any decrease in the thickness of the pyloric wall even seven months after gastro-enterostomy

Nicoll ²⁸ has suggested that there are minor cases in which there is simply a spasm and that these are alone cured by medical treatment and more severe cases in which surgical treatment alone avails Hutchison ²⁷ does not believe in this view for his own cases successfully treated by medical means all showed the classical features in a pronounced degree Although it is very possible that there is a certain amount of truth in this distinction, it cannot be definitely accepted whilst our knowledge of the pathology remains so indefinite, moreover, even if it is true it would be a very difficult matter to determine which of the cases were suffering from spasm and which were those in which hypertrophy was present From a practical point of view it is necessary to have some arbitrary line of distinction between the cases treated medically and those demanding operation Since there is so much evidence that if a definite tumor be felt, but little if any increase of lumen can take place, it seems essential that all such cases should have

early surgical intervention. In other cases the method likely to be followed with the greatest amount of success is that of limiting medical treatment to a definite time unless there are well-marked evidences of improvement under this treatment. It is true that Hutchison has stated that no time is too late for medical treatment and that cases by such means recover even when considered hopeless. But a greater part of the evidence seems to make clear that the longer such cases are left the less likely are they to recover by medical means. As regards the time limit to be set in such cases, I would suggest two weeks if the child is progressing unfavorably and three weeks if it is holding its own. It is perhaps unnecessary to point out that the best method of testing the reaction to treatment is a careful observation of the weight of the child. As regards the forms of treatment to be carried out, the medical methods will consist of careful dieting and gastric lavage, the details of which need not be considered further here. Cheimisse¹² believes that the sucking movements increase the pyloric spasm and advocates nasal feeding, while Batten² records a case cured by this method of treatment continued for 27 days.

As regards the methods of surgical treatment there are four operative measures which have been at various times carried out, namely, gastro-enterostomy, divulsion, pyloroplasty, and pylorectomy.

Mayo Robson³⁶ has collected together the results of these methods. As regards pylorectomy, Scudder,⁴⁶ Ibrahims,²⁸ and Fisk¹⁰ have all had a mortality of 100 per cent with this operation. It is therefore not to be advocated. The other results varied in efficacy with the different reporters. As regards pyloroplasty, many have had good results and mention has already been made of Nicoll's six cases with five recoveries. In these cases a "V Y" incision was made into the pylorus, the lumen thereby being considerably opened out. Rammstadt⁴² reports an interesting modification of this operation which he attributes to Weber. Here the wall of the pylorus is divided longitudinally as far down as the mucous coat and then allowed to gape. Coombe¹³ also advocates pyloroplasty as a most satisfactory operation. Divulsion suffers from the objection that the condition is liable to recur, and to be in any way satisfactory an incision has to be made into the stomach and thus but little time is saved.

Fredet and Tixier^{20,21} favor gastro-enterostomy and Scudder's series⁴⁶ of six consecutive successful cases certainly support this method of operation. Personally, I am strongly in favor of the latter operation. It is one which the majority of surgeons from their treatment of other stomach lesions will be much more familiar with, and will, therefore, be

DIFFUSE LYMPHANGIO-ENDOTHELIOMATOUS GROWTHS OF THE PERITONEUM

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THE patient was a Hindu, male, aged sixty years. He was admitted into hospital with a history of fulness in the abdomen of 1½ months' duration, and stated that he noticed the swelling first in the left iliac region. Since the appearance of the swelling he had vomiting, severe constipation and anorexia. He was gradually losing flesh and strength. The vomit was of a greenish-yellow color. He gave no history of cough or fever and there was nothing noteworthy in his family history.

The patient looked fairly nourished and had a fulness of the lower abdomen. On palpation an indistinct tumor was felt in the lower part of the abdominal cavity extending into both the iliac regions, its upper limit being about 2 fingers' breadth above the umbilicus. It had a soft, crumbling, doughy feel, was dull on percussion and was separated from the liver dulness by an area of resonance. The abdominal wall over the lower region of the tumor dulness was oedematous. The tumor was more distinctly felt in the left iliac region and around the umbilicus. There were no symptoms referable to the urinary system. A ballooned rectum was revealed on digital examination. The temperature was normal in hospital. The examination of the heart and lungs showed no evidence of disease.

A suspicion of tubercular peritonitis was entertained as the feel of the abdomen was very suggestive of it, especially that of *tabes mesenterica*. An exploratory laparotomy was performed by an incision to the left side of the middle line. Clear yellowish fluid escaped from the peritoneal cavity and the intestines were found thickened and matted together. The small intestines were drawn back to the posterior abdominal wall owing to the thickening and contraction of the mesentery. The omentum was thickened, contracted and hanging in folds. As the disease was extensive the abdominal wound had to be closed and nothing could possibly be done for the patient. He died the day after the operation and a post-mortem examination on him was conducted by Major H Kirkpatrick, I M S, and myself.

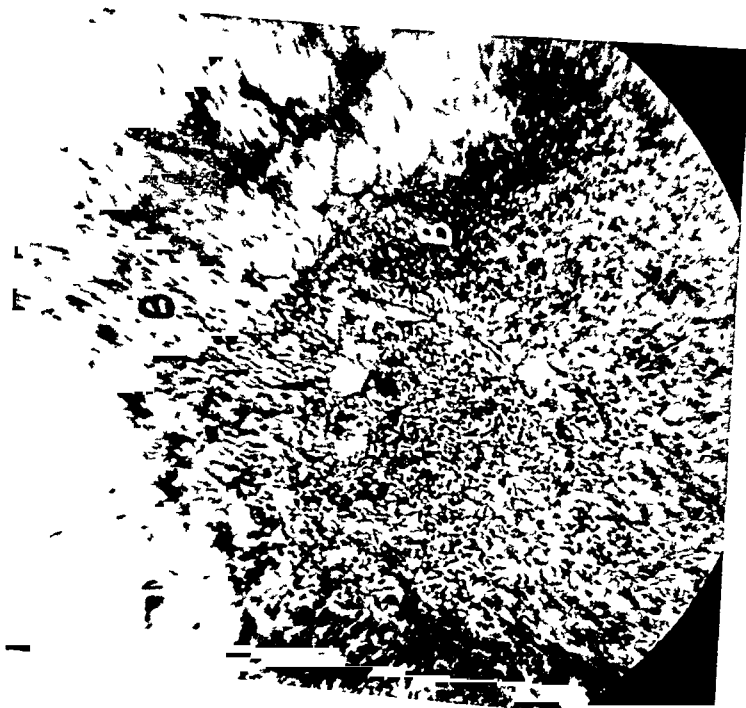
The body was that of a fairly nourished man (height 5 feet 4 inches, weight 104 pounds). Rigor mortis was present and there was no post-

FIG 1



The wall of the large intestine showing raised nodular growths.

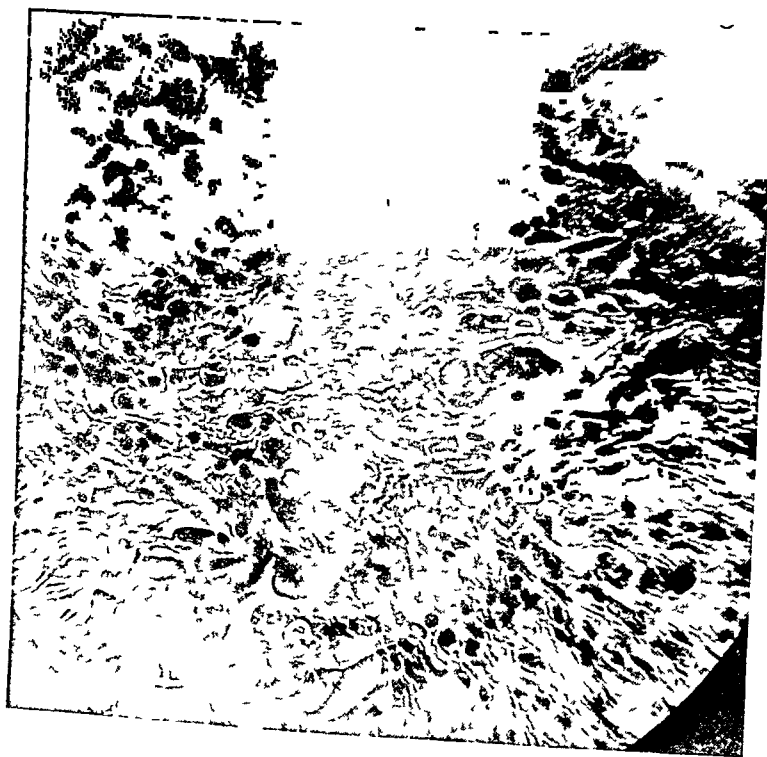
Fig. -a



Low power

A areas containing fat, B places near the fatty tissue where the cell infiltration is most marked, C surrounding fibrous tissue infiltrated by cells, D loculi in the fibrous tissue containing groups of large oval cells, E small loculi in which the cells lie singly or in pairs, F, the fibrous tissue which has become hyaline

Fig. -b



High power

A areas containing fat, B places near the fatty tissue where the cell infiltration is most marked, C surrounding fibrous tissue infiltrated by cells, D loculi in the fibrous tissue containing groups of large oval cells, E small loculi in which the cells lie singly or in pairs, F, the fibrous tissue which has become hyaline

PERITONEAL LYMPHANGIOM-ENDOTHELIOMATA

mortem staining On the left side of the abdomen was a recent operation wound about 6 inches long from above downward, stitched up with fishing gut On opening the abdomen the intestines were found semi-distended, their coils glued to each other and in the lower part of the abdomen reddish in color The peritoneum, both visceral and parietal, but especially the latter, was found covered with numerous, firm, raised, yellowish-gray plaques and nodules Over the cæcum and ascending, transverse and descending colons there were numerous, firm, yellowish nodules, like peas and beans The peritoneal cavity contained about a pint of blood stained fluid On opening the thorax the lungs showed no adhesions to the parietes and about 4 ounces of blood stained fluid was found in each pleural cavity The heart and lungs presented nothing deserving note The kidneys were normal

The *spleen* was medium sized with thickened capsule and kept its shape The lower pole was stained dark greenish as a result of post-mortem decomposition A few small yellowish, pin-head-like, raised deposits resembling tubercle were seen on the surface On section they were found limited to the capsule and were not seen to extend into the substance of the spleen. The spleen was of a deep red color, normal in consistency and showed trabecular markings

The *liver* was firmly adherent to the diaphragm The pylorus and duodenum were adherent to the under surface of the liver The surface was of a yellowish-grey color and smooth On section it was of a pale grey color with a firmer consistency than normal and lobular markings were faintly visible in places

The *intestines* were removed with difficulty, as the mesentery was shortened and very much thickened and the intestines were glued to each other by adhesions which offered some resistance to break down The mesenteric glands were not enlarged There was no omentum to be seen It was represented by a thickened mass covered with firm yellowish nodules adherent to the transverse colon The wall of the large intestine was very much thickened all through and the peritoneal surface was studded with numerous firm, raised, yellow, nodular deposits replacing the appendices epiploicæ (Fig 1) No caseating glands were found in the thickened mesentery No ulcers were seen in the intestines The stomach and pancreas were normal

The appearances at the time of the operation and at the post-mortem examination suggested a chronic tubercular peritonitis, though of an unusual type

Microscopical examination of sections of peritoneal deposits, yellowish nodules over the large intestines and nodular yellowish masses attached to the transverse colon, was made The sections show a general condition of fibrosis In places the fibrous tissue is hyaline The fatty tissue is invaded by fibrosis, and small loculi can be seen in the tissue which contain cells which are oval in shape, having a large proportion of protoplasm, which in many cases is fatty These cells are most numerous near the fatty tissue In the yellowish deposits over the large intestine, the fibrous tissue is somewhat hyaline and some small multinucleated cells are present The nuclei of these cells are large, about four occupy-

ing the cell In places the section has the appearance of a scirrhus carcinoma, but very few cells are present in each loculus (Figs 2a and 2b)

No giant cells, caseating areas or giant cell systems were found

Sections of deposit over the capsule of the spleen consist of a hyaline fibrous tissue which is arranged in a whorl, the centre of which is necrotic

The microscopical appearances of these nodular deposits were very much unlike those of tubercle There were no history of hectic fever, no primary lesion in the lungs or ulceration of the intestines or caseating glands in the mesentery The deposits are in the form of patches, plaques, and yellowish nodular masses unlike the miliary tubercular deposits which are usually about the size of a pin point or pin's head scattered over, chiefly along the blood-vessels, with slight surrounding hyperæmia The appearances are those of some form of chronic productive inflammation other than tubercle

The only reference to a similar condition that I am able to find in the literature available to me is obtained from the Principles of Pathology—Systemic—by J George Adams who states, "Another important primary growth, although not at all common, is the endothelioma This occurs in the form of multiple small plaques or warty excrescences, or again diffusely in more or less extensive sheets It begins in a proliferation of the lining endothelium of the cavity or possibly from the perivascular lymphatics The condition is sometimes associated with the effusion of fluid, occasionally bloody, together with deposit of fibrin, so that it simulates a chronic productive inflammation Metastases are not common Histologically the growth resembles an alveolar carcinoma"

The condition is probably one of a diffuse lymphangio-endotheliomatous proliferation of the peritoneum causing a chronic proliferative and productive inflammation of the peritoneum

REFERENCES

- ¹ General Hospital, Post-mortem Records, P M, 609, February 2-12, 1912
- ² Record of pathological specimens for section cutting for the year 1912 Pathological Laboratory, Medical College
- ³ Catalogue of the Medical College, Museum
- ⁴ Principles of Pathology—Systemic—J George Adams, Ed 1911, page 517

TUMOR AT THE MEATUS URINARIUS IN THE FEMALE

BY BENJAMIN TENNEY, M.D.

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JUNE 6, 1913, a female infant of four and a half months was brought to the Boston Dispensary by an agent of the Society for Prevention of Cruelty to Children and two alcoholic parents. The only story obtainable was that of neglect and abuse by the parents, and the appearance of a vulvar tumor at some uncertain time previous to bringing the child in. There was also a suspicion of traumatism in the case.

The child was badly nourished, crying constantly, and straining as with tenesmus frequently. On separating the thighs a dark red tumor about a centimetre and a half in diameter showed between the labia majora below clitoris and in front of hymen. It was soft, velvety, and its surface was in several vertical folds. It seemed to come through the urethral opening and yet one probe passed in front of it as far as the umbilicus without meeting resistance and another passed in behind it, a shorter distance in a different direction without touching the first. The opening through which this tumor projected was too small to allow it to be replaced and every touch or attempt at replacement brought on spasms of straining and crying. No fluid was noticed flowing from or about it more than the reddish stain corresponding with handling the tumor. The labia and hymen were normal. The vagina was single with a single cervix. The clitoris was single and the pubic arch firm.

The child was evidently very sick and was admitted to the hospital for operation at once. None of the several men who saw the infant would hazard a diagnosis. It lay between a prolapsed bladder tumor and a strangulated intestinal hernia through an artificial opening. Under ether reduction was impossible. A small opening was made in the tumor and clear fluid came from this opening. A bit of tissue was cut from the edge of the opening and preserved for the pathologist. It then became possible to reduce the mass which had come out through the meatus. Two probes were again introduced with the same result as before, one passing to the umbilical region while the other could be passed back, leaving tissue between the two.

We were still uncertain of our tumor origin and I decided to open the abdomen, to make sure I had not opened the intestine, and

when given, suggests a congenital condition. In the other case the history given does not decide when the obstruction first occurred. Neither do the histories throw much light on the appearance and feel of the tumors. Lechler's case from Bottomley's list is noteworthy in its absence of urethra.

III *Prolapse of Bladder Tumor*—One case has been published by Mordert.¹ His patient was a married adult with urinary symptoms for five or six years. On separating the labia a gangrenous tumor appeared, the size of a thumb, with a pedicle coming through the urethra. His finger passed into the bladder, and the pedicle was found to be attached in the region of the trigone and surrounded by easily bleeding villous masses. It was removed with finger and curette. Five months after operation she was still free from unpleasant symptoms. No examination of tumor is reported.

Few cases of this, which is but a complication of the more serious condition, appear in the indices to medical literature. There is no reason why an intravesical new growth of proper size and location should escape prolapse more than the dilated ureters of which several have been recorded. It is very likely that these form a larger part of the tumors seen at the meatus than this paper shows.

IV *Prolapse of Urethra*—In Legueu's *Surgical Urology* is found a minute description of this condition. He says that two-thirds of the cases appear before the age of fifteen, very few between that and fifty, and the rest beyond. A variety of causes are suggested but none proven or even generally accepted. The prolapse is circular usually, but may be partial. Its appearance is accompanied by pain in urinating and some drops of blood after. In complete prolapse, of which he has seen one case, the external surface of the tumor was directly continuous with the lining membrane of the vestibule. No space existed between the tumor and the muscular wall of the urethra, but a probe passed easily through a central depression into the bladder.

HAMMOND² reports a case of a female of five with a bloody and foul vaginal discharge. There was no pain in urinating and no frequency. A tumor was visible behind the clitoris the "color and size of a damson plum." Under anesthesia it was found to be a prolapsed urethra to the extent of about five-eighths of an inch all around. It was dark purple and almost sloughing and was cut away, the edges being sutured with catgut. He noted that the pelvic floor was loose and relaxed more than usual for the patient's age.

A more typical case was recently operated by Dr. Charles G. Mixer who has kindly given me these notes. A woman of seventy, who had borne several children, had no symptoms except frequency of micturition until four days be-

¹ Mordert *Archiv. Med. d'Angiers*, 1900, p. 220.

² Hammond *Lancet*, December 7, 1912, p. 1584.

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At autopsy one ureter was found with cystiform protrusion into the bladder and passing down into the urethra

LECHLER Female, three months old Shrieked with every urination Labia majora separated by cyst the size of pigeon's egg Cyst was tense and appeared to come through vaginal opening Looked like the bladder It was replaced but on the third day appeared again Urine suddenly shot out from it Death in twenty-eight hours At autopsy the urethra was wanting, the neck of the bladder opening directly into the outer air The bladder was then opened through its anterior wall and there appeared a second bladder within, which was the dilated blind end of the ureter

JOHNSON Female, ten days old Died of infection four days after rupture of a bulbous protrusion between the labia Autopsy showed a protrusion from left side of bladder covered with mucous membrane, extending downward and gradually increasing in size and with the parts in their natural position occupying the whole length of the dilated urethra and beyond On its right side is a rent opening into a hollow interior through which a probe passes into the ureter Other viscera normal

JOHN CROFT⁴ gives the following observation Female, fourteen months, presented a tumor the size of a walnut at the vulva This burst during examination and clear fluid flowed from it It was replaced in the bladder after rupture and returned several times, but finally remained out of sight

ANDRIA MARRO⁵ describes a female of thirty-nine years, with a fleshy tumor showing at the meatus after her third child Surface showed folds, it was reddish-gray in color, soft and compressible, with a central cavity and a wall suggesting bladder tissue Urethra easily admitted a finger and the tumor was felt attached to the right wall of the bladder Patient incontinent Right kidney large and movable Some pus came from the tumor during handling and the tumor was slowly emptied A ureteral catheter was pushed through it up to the kidney from which 20 cc. of pus were withdrawn Tumor reduced and bladder filled with gauze to retain it This had to be removed on account of pain and the tumor reappeared Six weeks were spent in draining and irrigating the ureter and kidney pelvis The bladder was then opened and the projecting ureter removed The patient three years later was well and passing a clear, normal urine He refers to a case of Colley, and one of Caille's also, with prolapse of the ureter through the urethra Kallisko has also reported a case of this sort according to Legueu The original reports are not available here

SIMON⁶ reports an adult patient with a tumor resembling a polyp at the meatus It had a distinct pedicle coming from the urethra Bimanually he felt a long rounded tumor to the left of the bladder the size of a baby's arm At operation the tumor proved to be the dilated pelvic portion of the ureter which was still further dilated and filled with pus outside the bladder He removed the prolapsed end and reimplanted the upper part, with good results

The total of nine cases reported up to date suggests the exceeding rarity of this condition The early age of all but one of these cases,

⁴ Croft St Thomas Hospital Reports, New Series, vol 11, 1871

⁵ Marro Abst Jour d'Urol, vol 111 No 6, p 803

⁶ Simon Centralbl f Gynakol, 1905, p 76

This did not keep the mass in and he finally injected hard paraffin about the urethra with results that were satisfactory for months

A similar case was reported by LEECH¹² A female of six months presented a small red mass below the clitoris This disappeared under pressure, but reappeared and increased to the "size of a duck's egg" Urine could be seen trickling from the ureteral orifices He split the urethra with a probe-pointed bistoury and returned the mass through it He reports no recurrence

CROSSE¹³ has reported the case of a female of two and a half years The child showed a florid red tumor, the size of a walnut, visible at the vulva Two ureteral orifices were seen both delivering clear urine When the tumor was reduced the urethra admitted the little finger The prolapse remained reduced till the patient was sixteen years old, though she had complete incontinence

Croft in his paper also refers to a case of Murphy's with similar appearance, in which both ureters were probed This was reduced and the individual recovered Also one of Lowe in a female of two and a half years A vascular tumor the size of a large walnut which received some relief from treatment by cautery

SOKOLOVA¹⁴ describes the case of a female of eighteen months At six months, after a vigorous cathartic, she had prolapse of rectum and a red tumor the size of a cherry at the meatus On the back of the tumor was a small triangle suggesting the trigone with ureters Urine was drawn from each The tumor was reduced under an anæsthetic and the vulva packed with gauze held by a pad and a bandage The child was constantly incontinent and left the hospital in five days with no relapse

Another case is described by HOUZEL¹⁵ which is peculiarly interesting as showing a definite defect in development which may have existed under the surface in the preceding cases of prolapse

His personal case was a female of thirteen months with a strangulated purple tumor at the vulva of two days' duration It was in folds and apparently covered with mucous membrane There was a history of previous appearances of mucous membrane at this spot from birth, but they had been easily reduced either spontaneously or by digital pressure He was able to reduce the tumor into the bladder under anæsthesia and then did a plastic operation to prevent recurrence The infant had a bifid clitoris and an ununited symphysis

Apart from the prolapse he discusses four other cases of female congenital incontinence One was twenty-two, two young girls, and one an infant All were less incontinent standing than lying down Two had bifid clitoris and two had imperfect pubic union One was operated on several times with final control of urine for four-hour periods

These five cases of Houzel all had a visible congenital defect The bladder mucosa was visible as a red spot and all were incontinent They were either cases of partial exstrophy of the bladder or of female epispadias

¹² Leech Brit Med Jour, 1896, 11, p 1128

¹³ Crose Trans Provin Med Surg Assn, 1846

¹⁴ Sokolova Abst Jour d'Urologie, vol 11, No 6, p 896

¹⁵ Houzel Jour d'Urologie, vol 11, No 1, p 25

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Is it not possible that in the cases of prolapse of the bladder before reported there was some failure in the development of the muscular tissue about the urethra which left a weak spot for the bladder to stretch and drop through? It seems a reasonable theory and in accord with what we now believe of the more common herniæ. The actual weight of an infant's bladder when filled is trifling. Moreover, they are lying down so much of the time that gravity can act but little. It is suggestive that the infants with prolapsed ureters were seen earlier than those with prolapsed bladder. This may be the difference between the sudden delivery of a tumor existing before birth as compared with the development of a tumor through a weak, and incomplete urethra. The number of times that the finger could be introduced into the bladder is also suggestive of an incomplete sphincteric apparatus. Two cases of complete inversion of the bladder following surgical removal or injury of the urethra suggest a relation between the imperfect sphincter and bladder prolapse. Both had laparotomies for repair and in neither case was any intra-abdominal cause for the inversion found^{16,17}

No report has been found of intestinal hernia through the urethra following violence as was suggested in my case.

The sudden appearance of the tumor, the tissue between the two probes inserted into the bladder, the escape of clear fluid from the nick in the tumor, the much dilated and hypertrophied bladder suggesting repeated effort to overcome some obstruction, and the age of the child lead me to the conclusion that my patient had an intravesical dilatation of the ureter which prolapsed through the urethra and appeared at the meatus.

CONCLUSIONS

There are six conditions under which tumor may appear at the female meatus.

1 *Papillary Adenoma*—Dysuria, pain with physical contact, sometimes slight bloody staining. Not larger than 1 cm., and usually smaller, usually single, varying shades of red, attached on one side of canal and usually the posterior, uncommon, except between fifteen and forty years, rarely malignant, frequently recur after removal.

2 *Prolapse of Dilated Ureter*—Dysuria, pollakiuria. Tumor cyst like a flaccid mucous membrane, "size of thumb" or less, appearing either within a few weeks of birth or after months or years of vesical irritation and one-sided symptoms. Probe can be passed all around the

¹⁶ Pique Bull et Mem de la Soc. de Chemie, xxviii, 1902, p 636

¹⁷ Heimsins Abs Jour d'Urol, vol No 4, p 567

pedicle except for one spot Sometimes mouth of ureter can be identified Constant tenesmus

3 *Prolapse of Bladder Tumor*—Hæmaturia, dysuria, pollakiuria. Size and structure must vary Rare in children Tumor follows long train of bladder symptoms

4 *Prolapse of Urethra*—Symptoms like papillary adenoma except for absence of pain and tenderness In one case came out five-eighths of an inch Central canal through which probe passes into bladder Said to occur in infants and elderly people

5 *Prolapse of Bladder Mucosa*—Only recorded case had symptoms corresponding to intravesical stricture and dilatation of ureter followed by appearance of a fold of mucous membrane at the meatus

6 *Prolapse of Bladder Wall*—Pain, tenesmus, spasm and incontinence at intervals preceding appearance of tumor Tumor "size of cherry" to "size of duck's egg," tender, purple, pyriform in shape, bleeding on handling Sometimes ureteral orifices can be identified on the back of tumor May be reducible or not May occur in infants as result of imperfect sphincter apparatus or in adults after injury to same.

TRAUMATIC INTRA-ACETABULAR SEPARATION OF THE PELVIC BONES (EPIPHYSEAL DIASTASIS IN THE ACETABULUM)

BY HAROLD NEUHOF, M.D.
OF NEW YORK CITY

(From the Surgical Department of the Mount Sinai Hospital Dispensary)

FRACTURES limited to the cotyloid cavity are occasionally encountered, and a few cases in which the ossified acetabulum was split into its original three parts have been described. An examination of the literature fails to reveal any instance of intra-acetabular separation of the juvenile pelvic bones not associated with other lesions of the pelvis¹. For this reason the following case is reported.

B. V., a girl six and one-half years old, came under observation in the early part of January of this year. The previous history has no bearing on the present condition. Seven days before admission, the child fell while romping about at home. The mother, who saw the accident, states that the left leg was extended backward as the girl stumbled and seemed to buckle under her as she fell, the left hip striking the floor. The child immediately complained of severe pain in the left hip and thigh, and was put to bed. She remained there for four days, suffering considerable pain, especially at night, analgesics were prescribed by the physician in attendance. After leaving bed, the child continued to complain of pain and walked with a marked limp of the left leg. These symptoms had abated somewhat by the time the child appeared at the Clinic.

Examination—A well-nourished child without any clinical evidence of tuberculosis. She walks only when urged to do so, and then with a very pronounced limp of the left lower extremity. No ecchymoses are to be seen. When the child stands at rest a moderate upward tilting of the left side of the pelvis is noted. With the child in the supine posture an inspection shows that the

¹ There are a few museum specimens that "show the possibility of partial or complete separation of the epiphyseal ends of the pubis, ischium, and ilium at the hip-joint" (Poland, *Traumatic Separation of the Epiphyses*, London, 1898). They present associated fractures of the pelvic bones, evidently the results of violent traumata. It is unfortunate that Poland was unable to obtain any history or details of a specimen (shown by Stokes in 1881) that might have had some bearing on the case I report.

HAROLD NEUHOF

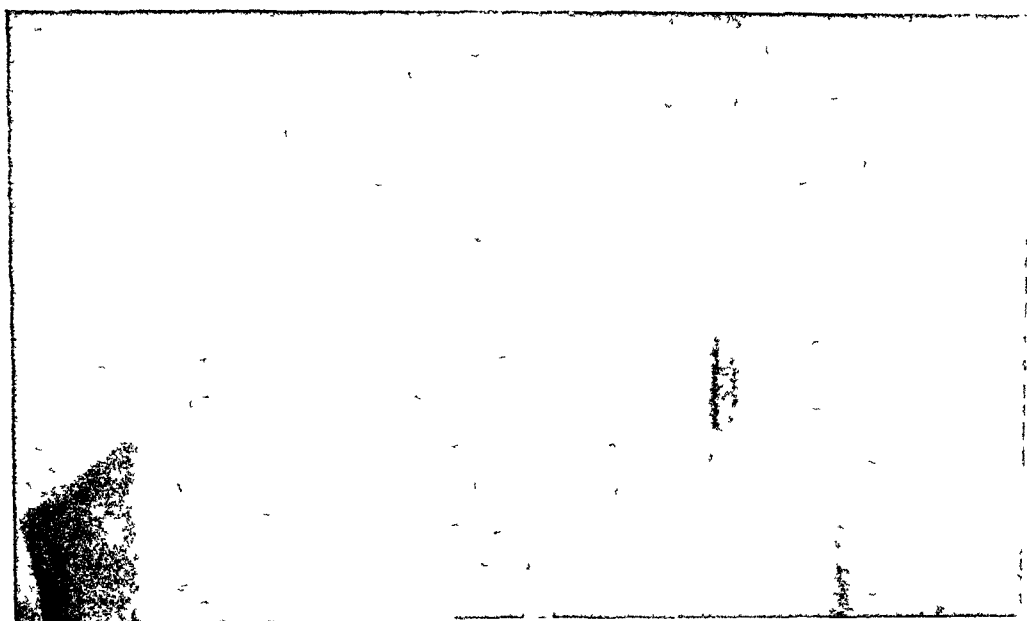
left great trochanter is somewhat less prominent than the right, the left Scarpa's triangle, however, appears abnormally full. The left thigh is in moderate adduction and internal rotation. Active motions at the hip are somewhat restricted in all directions, especially in abduction. Passive movements are limited to a much lesser degree. Painful spasms are the evident cause of the limitation of the motions at the hip. On palpation, a peculiar, dough-like consistency of the soft parts about the left great trochanter can be determined. A spastic contraction of the muscles of Scarpa's triangle can also be felt, the visible prominence of this region is the result, apparently. There is no tenderness upon pressure at various points about the upper end of the left femur. When the great trochanter is pressed toward the acetabulum, however, considerable pain is elicited. Pain also results from gentle manipulations that tend to approximate the left anterior superior iliac spine and the tuber ischii. Upon rectal examination there is marked tenderness on pressure against the left side of the pelvis, no irregularities in contour can be felt.

Comparative measurements of the lower extremities were carefully made, the differences, though distinct, were very slight, as the following table shows

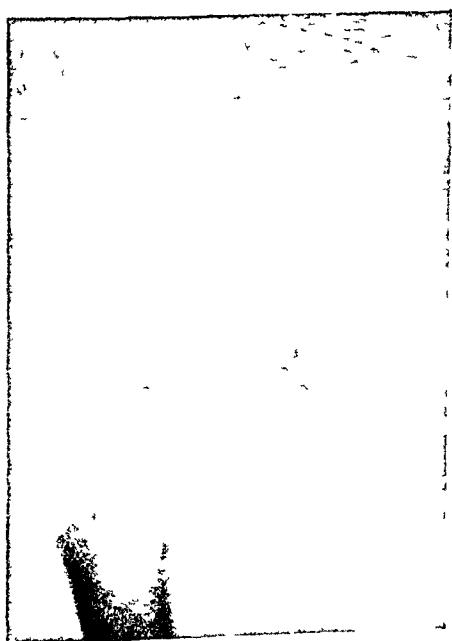
	Left cm	Right cm
Umbilicus to internal malleolus	55 75	56 75
Anterior superior spine to internal malleolus	51 5	52 5
Anterior superior spine to upper border of patella	26 25	27
Great trochanter to external malleolus	50 25	50
Anterior superior spine to tuber ischii	20 25	19
Anterior superior spine to anterior border of great trochanter	6	7 25
Anterior border of great trochanter to tuber ischii	14 25	11 75
Great trochanter to highest level of iliac crest	10	11
Great trochanter below Nelaton's line	0 75	1 5

These measurements indicated that the left great trochanter was slightly displaced forward and upward, and that the left half of the pelvis was slightly broadened in the sagittal plane.

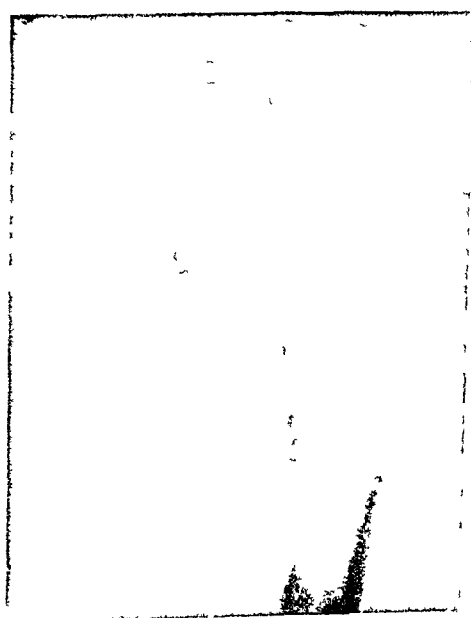
Before the X-ray examination three conditions were considered in the diagnosis. Fracture of the neck of the femur, fracture of the pelvis, coxitis (simple traumatic or tuberculous). The last mentioned could not be positively excluded but did not appear likely in view of the frank history of trauma (although a history of trauma not infrequently precedes a history of tuberculous coxitis) and its immediate sequelæ, and the findings at the physical examination. It was likewise impossible to exclude



Rontgen picture taken seven days after injury



The left hip seventeen days after injury



The right hip taken at the same time as Fig. 2

that may cause it, and a mild clinical course. A typical case shows neither ecchymoses nor œdema. The trochanteric region of the affected side is flattened and the trochanter is abnormally elevated and abnormally near the anterosuperior spine. Swelling and tenderness over the internal aspect of the pelvis may be found at rectal examination. The limb generally lies in external rotation and abduction, adduction and internal rotation are sometimes observed, however. The affected limb is shorter than the normal, in direct proportion to the elevation of the great trochanter. The movements at the hip are very limited or are prevented by pain. X-ray examination shows either a linear fracture or an upright or inverted Y-shaped one. This type of fracture might be considered unimportant were it not occasionally complicated by injury to the obturator nerve, and, especially, by an arthritis that may terminate in complete ankylosis of the hip.

A number of cases have been described in which violent trauma, shattering the cotyloid cavity, forces the femoral head into the pelvis. This so-called "central dislocation of the femur" is mentioned here because it appears to me to be an advanced grade of the simple and isolated fracture of the cotyloid cavity. The striking analogy between the latter and the case of epiphyseal separation in the acetabulum that I have reported leads me to believe that they are the adult and the juvenile representations of one lesion. The conclusion is, therefore, reached that the reported instance of intra-acetabular separation of the pelvic bones is not a bizarre, unique effect of a combination of forces, but rather a condition that will be occasionally encountered in the young as the counterpart of the lesion sometimes met with in the adult.

a fracture of the femoral neck, however, the absence of tenderness in the upper end of the bone, and the pelvic findings by measurement and by rectal examination pointed away from that condition. Although it could not be definitely established, an injury of the left acetabulum was considered the most probable diagnosis for the following reasons: 1 The localized tenderness of the left side of the pelvis upon rectal examination, 2 the flattening of the left hip in the region of the great trochanter, 3 the widening, albeit very slight, of the left side of the pelvis in the sagittal plane, 4 the slight forward and upward displacement of the great trochanter, 5 by probable exclusion of other conditions.

The X-ray examination demonstrates a separation of the pelvic bones through their epiphyseal line in the acetabulum. The ilium, above, is detached from the ischium and pubis, below. There is no separation between the last named bones. The photograph shows that the displacement is very slight and that the diastasis is not very marked. It also shows that the head of the left femur lies more deeply in the acetabulum than that of the normal side.

After ten days' rest in bed (the parents of the child refused to have the hip immobilized) the patient returned for re-examination. She had been very comfortable and now walks with a barely perceptible limp. The tilt of the pelvis is almost entirely gone. There is very slight spasm with passive and active motions at the hip. The localized tenderness is found to persist, upon rectal examination, and there is, besides, some boggy softness of the soft parts between the rectal wall and the left side of the pelvis (hematoma?). Measurements between the points employed at the first examination are now practically the same on both sides. The X-ray examination shows very little change in the appearance of the parts. The application of a plaster-of-Paris hip spica was consented to and was kept on for four weeks.

The final examination, made three months after the injury, reveals no abnormality. Rectal examination is negative. Full motion is present at the hip. X-ray examination is negative.

There is considerable similarity between the lesion above described and the simple and limited fractures of the cotyloid cavity of adults first reported by Kontorowitch² and by Thévenot³. These observers characterized the fracture they described by its limitation to the acetabulum, minimal displacement of the fragments, the insignificant trauma

²Mlle D. Kontorowitch. Contribution à l'Étude des Fractures du Bassin. Fracture Simple et Limitée de la Cavité Cotyloïde. Thèse de Lyon, 1903.

³L. Thévenot. Revue de Chirurgie, February, 1904. Revue d'Orthopédie, March, 1904.

THE PREPARATION OF DRY BONY AREAS FOR SKIN GRAFTING

BY CHARLES H. MAYO, M.D.

OF ROCHESTER, MINNESOTA

THE method herewith described for hastening the healing of denuded surfaces of bone is so seldom used as to warrant a brief description. The extreme slowness of healing of such large exposed areas of bone is a source of great discomfort as well as prolonged disability to the patient. Such areas may be located on the tibia or the maxilla, but are usually on the skull, most commonly occasioned by denudation from traumatic scalping. Cases have been reported that were from one to two years in healing. They may have been occasioned by burns, by infections—especially with the pneumococcus—or by the removal of large malignant periosteal growths. In the latter case, the periosteum being involved in the growth, the safest surgical procedure is radical excision of the scalp with the tumor and scraping of the periosteum from the bone. Malignant disease of the periosteum has a great tendency to recur and is best treated by thorough application of the actual cautery to the bony surface. Occasionally such a wound may be covered by skin-grafting or by sliding over it adjacent tissue. Such areas are often too large and unfavorably located to cover with pedicled flaps, and in malignancy it is not always advisable to do so, nor to attempt immediate skin grafting, as thereby one may cover areas containing undestroyed malignant cells. If the wound is left open, should disease recur, it may be recognized early and subjected to treatment. The margins of the wound throw out granulation tissue which soon starts a red line of osteoporosis at the margin of the exposed bone. After many months the hard outer layer either shells off in a flake or comes away in particles as the granulations spread over the wound after penetrating the outer bony layer. The process, however, may require several months before a suitable area for skin grafting is secured.

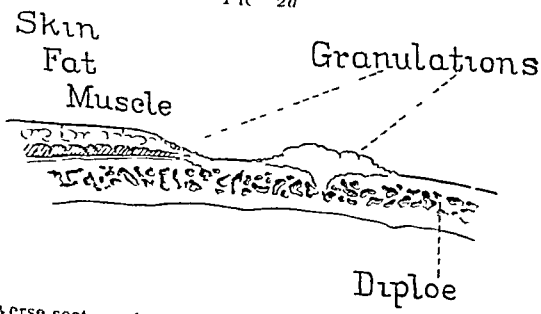
To avoid this long delay, for many years I have practised a method which has reduced to a short period a process which formerly took months. The principle involved is not new, but the simplicity of the technic readily adapts it to frequent use. By means of a small drill the entire dry area of bone is perforated like a sieve, or cribriform plate, all over its surface (Fig 1). These perforations are about a

FIG 2



Granulations appearing through outer plate for blood supply to graft

FIG 2a



Transverse section showing granulations and opening into diploe

quarter of an inch apart and penetrate to the diploe of the skull or to the blood supply of the bone involved so that each perforation shows a slight hemorrhage. Through these perforations, granulations are rapidly thrown out and soon merge together on the surface, allowing an abundant blood supply for the skin grafts (Fig 2)

Since infection of the diploe or vascular area of the bone may occur, such a wound must receive excellent care at least until protective granulations appear. During a number of years past several cases have been thus treated. These have included large areas of the skull remaining after the excision of carcinoma, sarcoma, or infections with pneumococci. The speedy healing of the wound has been very gratifying.

Occasionally, also recurring ulcer of the leg in elderly people involves the bone. The usual history is that when young they had a prolonged osteomyelitis with extensive destruction of both bone and soft tissues. The scar of the skin is solidly attached to the bone which early in life furnishes nutrition to it, but as time passes the bone becomes of ivory hardness and occasions indolent ulcers, due to malnutrition, which recur from time to time. While some cases may be readily covered by sliding adjacent tissue over the areas, it is a simple process to drill a few openings into the bone until it bleeds freely. The resulting granulation tissue with its new vessels then furnishes nutrition for the denuded bone.

THUMB FORCEPS TO FACILITATE ANASTOMOSIS

BY ARTHUR N. COLLINS, M.D.

OF DULUTH, MINN

THE Connell-Mayo running suture has for its purpose inverting the cut edges when closing wounds in hollow viscera—stomach, intestine, bladder. The technic usually employed consists in entering the needle on the peritoneal side, passing through all coats including the mucous, and returning directly backward from mucous to peritoneal of the same side. By thus alternating from one side of the wound to the other and pulling taut the sutures, the peritoneal surfaces of the cut edges are rolled under and into contact. Frequently anastomosis must be done in the shortest possible time. A measure which reduces the number or extent of manœuvres in technic shortens the time of operation.

The writer has devised a forceps, shown in the accompanying illustration, to aid in gathering all the coats of the visceral wall and in both directions (in and out) by one puncture of the needle.

One arm of the forceps has at its end two branches or extensions, running parallel to each other and to the arm. The other arm has but one branch or extension but bent in such a fashion that it passes between and beyond the two branches of the first arm when the forceps is pinched together.

When the edge of the stomach or intestine or bladder, as the case may be, is caught up in this forceps, the tissue is pressed between the parallel branches sufficiently far so that the needle may penetrate from serous to mucous side, and back from mucous to serous with one thrust of the needle. When the procedure is repeated on the opposite edge and the suture is pulled taut, this gives a running mattress suture.

The writer has found this instrument of especial value when approaching or finishing the last angle of the wound, inasmuch as the single branch or point of the forceps may be inserted into a very small aperture, and the tissue pressed up between the parallel branches of the other arm to receive the needle, thus allowing of a snug closure at the terminal end. It will readily be seen that a uniform-sized stitch may be taken along the whole length of the suture line.

FIG 1

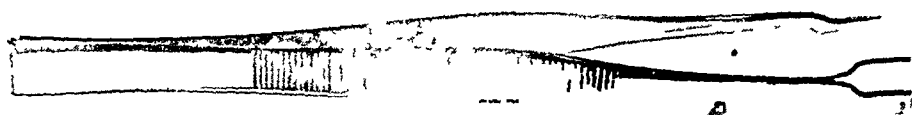
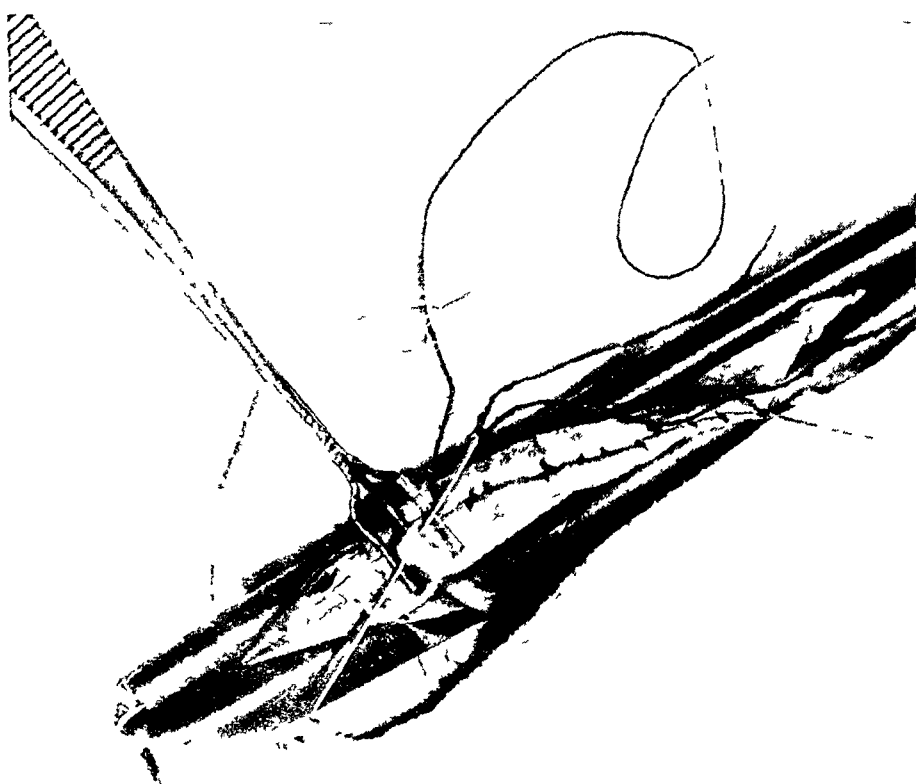


FIG 2



The single point is applied to the inner side and the edge of the tissue pressed upward and between the double parallel points. Seen in cross section the tissue is then in the form of a triangle through which the needle is inserted thus



The forceps will be more easily withdrawn after the suture has entered the tissue

PAGET'S DISEASE

by conservative treatment With the leg in an extended position, the fragment was therefore reduced as well as possible, and held reduced by strips of adhesive plaster The whole limb was then encased in a plaster-of-Paris bandage and elevated. It was kept in this position for six weeks, after which period massage and cautious active and passive motions were begun The boy was now slowly regaining the use of his limb, and judging by his recent progress, it was probable that eventually all motions would be completely restored.

Dr. Jaches, who made the X-ray exposures, reported as follows on October 30, 1913, the day following the injury "The tubercle of the right tibia is torn away from the shaft, and has taken along the anterior portion of the head of the tibia, the fracture entering the joint The fragment is slightly rotated upwards" On December 20, after removal of the plaster-of-Paris dressing, his report reads as follows "The tubercle and anterior portion of the right tibia, which had been broken off, are now united to the head and shaft, and are apparently held there firmly There is a slight irregularity in the outline of the head of the tibia, but the joint is perfectly free"

PAGET'S DISEASE

Dr Moschcowitz presented a boy, sixteen years old, born in the United States, of Russian descent His mother died of rheumatism The patient had three attacks of diphtheria, one of which was followed by a diphtheritic paralysis of the pharynx, with subsequent recovery He had attended the public school, and was always able to keep up with his classmates in his studies He was bright and wide awake, but it was noticeable that his memory of occurrences long past was not particularly active He was somewhat undersized and undeveloped for his age, and poorly nourished, although there were no complaints whatsoever relating to his general health

About eight years ago he first noticed a slight protuberance over the right parietal bone, and four years later a similar protrusion developed over the left cheek Both of these protrusions had increased in size very slowly, and, with the exception of the deformity they gave rise to, they caused him no complaint

Dr Moschcowitz said he had recognized the case as belonging to the group which was called by Virchow *leontiasis ossea* He referred the patient to Dr. I S Hirsch, who was kind enough to make a complete X-ray exposure of the entire osseous system, and his report, which was as follows, confirmed the diagnosis in every respect.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

*Stated Meeting, held at the New York Academy of Medicine,
February 11, 1914*

The President, DR FREDERIC KAMMERER, in the Chair

SCHLATTER'S DISEASE

DR A V MOSCHCOWITZ said that as was well known, Schlatter's disease was an avulsion of the tubercle of the tibia, and he had purposely placed this case on the programme under that title, if only to call attention to the fact that according to more recent studies, Schlatter's disease was not merely an avulsion of the tibial tubercle, but a generalized disease of the osseous system, giving manifest signs in X-ray pictures, which rendered the individual prone to such injuries as an avulsion of the tubercle of the tibia

The patient presented by Dr Moschcowitz was a boy, sixteen years of age, a college student, who, on October 29, 1913, while running to make a high jump in the gymnasium, and just at the moment of raising himself to make the jump, suddenly felt a sharp pain in the region of the right knee-joint. He did not fall, but there resulted immediately complete disability. When the speaker saw him, a few hours later, he found the knee-joint considerably swollen and distended with blood, and a rather large, movable fragment of bone which could be moved slightly with crepitus upon the subjacent tibia.

A diagnosis of avulsion of the tubercle of the tibia was made, and an X-ray picture, taken by Dr L. Jaches on the following day, not only verified the diagnosis, but also showed that not only the tubercle of the tibia, but a considerable portion of the tuberosities of the tibia were torn off, resulting practically in an intra-articular fracture of the head of the bone. There was considerable dislocation of the fragment, probably due to two circumstances: first, a certain amount of tilting caused by the attachment of the ligamentum patellæ, and, second, the distention of the joint and fragments by blood. In spite of this fact, Dr Moschcowitz believed that a good result, with less risk, could be obtained

FIG 1



Chondroma of upper jaw before operation

FIG 2



Chondroma of upper jaw before operation

"The Rontgen ray studies of your case prove it to be one of extreme interest, because it serves to emphasize the conviction that has been growing in the minds of those who have had the opportunity of seeing a number of these so-called types of osteitis deformans and osteitis fibrosa, or the Paget and von Recklinghausen, and osteodystrophy juvenalis cystica or Miculicz diseases, of the close relationship of these conditions to each other, and because your case seems to embody all the characteristics of the three types of the diseases above mentioned, as there are in the bones of your patient not only the changes of osteitis deformans, with bone thickening and deformity, but also those of osteitis obliterans, with obliteration of the medullary cavity by cortical invasion and the bowing of the long bones, but also those of multiple cyst formation, which is, perhaps, the terminal stage of this condition

"The characteristic finding seems to be enlargement of the Haversian canals, which are normally visible in the radiograph as fine, black, irregular dots, into a series of irregular shaped cavities, with eventually the formation of cysts. Associated with this there are other changes of marked cortical thickening which seems to ensheath the bone, the thickening being, as a rule, not confined to the entire shaft, but to localized areas, usually in the middle portion, resulting in a change in the shape of the long bones, giving them the form of truncated pyramids. This is especially noticeable in the phalanges and metacarpal bones.

"The epiphyses are apparently well formed, though the ossifying border seems to show as a line of unusual bone density. The epiphyseal line itself is irregular. The cysts have not the appearance of the isolated cysts frequently found in bones, in that the outlines are not as sharply defined, and the cyst wall merges gradually into the normal bone markings of the surrounding bone. Furthermore, the cavity itself does not show so clearly the bone absorption. Then, too, the form of these cysts in this condition is not as spherical and symmetrical as those seen in the isolated cysts, because the condition here, as has been pointed out, is due to an enlargement of the Haversian canals into lacunæ. The cysts are really the result of the coalescence of these lacunæ.

"In this case, also, there appears to be an obliteration of the sphenoid sinus, the frontalis not being visible. The sphenoidal sinus appears to be entirely obliterated. The sella turcica is small, while the clinoid processes show hypertrophy. These areas of absorption are also visible in the occiput, associated with thickening.

"The bones of the right hand seem to illustrate every variety of lesion, the middle metacarpal bones showing the cortical thickening and deformity, the proximal phalanges of the middle finger showing the cystic formation, while the middle phalanx shows evidence of cystic formation, with intervening ridges of increased bone density. The fifth metacarpal bone of the left hand shows the beginning formation of a large cyst, and a small multilocular one is visible in the base of the second metacarpal bone. The terminal tufts of the phalanges seem to be poorly developed, in marked contrast to the hands of acromegalics.

"The upper ends of the fibulæ show evidence of cortical thickening, with obliteration of the medullary cavity by new bone formation, while the lower ends show evidence of cystic formation. Large multilocular cysts are visible in the os calcis, while the peculiar bowing, with irregular cyst formation and some thickening of the cortex, characterized the condition of the fifth metatarsal bone. On the whole, the epiphysis formation seems somewhat delayed. The fingers of

FIG 1



Chondroma of upper jaw before operation

FIG 2



Chondroma of upper jaw before operation

FIG 3



Chondroma of upper jaw after operation

FIG 4



Showing condition after operation

CHONDROMA OF THE SUPERIOR MAXILLÆ

the hand have a peculiar tapering shape, due to the deformity already referred to, the enlargement of the bases of the metacarpal bones and the phalanges making them so that the normal cylindrical formation of the bone is lost "

Dr Moschcowitz said that if bone cysts in single bones were excluded, this disease was one of comparative rarity. It was first described by Paget, and its pathology was very carefully studied by Recklinghausen. Virchow described it under the name of *leontiasis ossea*. While there was a lack of unanimity in the description of the pathology of the condition, it became more and more evident that all these diseases were the same.

The question of therapy was an important one, and it was particularly with that point in view that the case was presented. There was no marked change in the sella turcica, yet the question arose whether or not the patient would be benefited by the administration of some of the internal secretions. Rather favorable results had been reported from the use of pituitary extract.

CHONDROMA OF THE SUPERIOR MAXILLÆ

DR WILLIAM B COLEY presented a man, forty-two years old, who was referred to him by Dr T J Reardon of Boston, with the history that twenty years ago, immediately following a slight injury, he noticed a small, hard lump on the malar bone, just to the left of the nose. It increased in size for a short time, and then remained practically stationary for sixteen years. Four years ago it again began to grow and had been steadily increasing in size ever since.

When the patient was admitted to the General Memorial Hospital, on December 9, 1913, examination showed a tumor occupying the entire upper jaw and nasal bones, and apparently extending back into the sphenoid and base of the skull (Figs 1 and 2). The overlying skin was normal in appearance, and not adherent to the tumor. The latter was of very firm consistence, so much so that Dr Coley believed he was probably dealing with an adamantinoma rather than a sarcoma, the long duration of the growth also favoring the former diagnosis. The tumor produced a very remarkable deformity, an idea of which could be gained from the accompanying photographs better than from any description. All the teeth in the upper jaw were absent, and the tumor projected forward nearly three inches beyond the incisor teeth of the lower jaw and about one inch beyond the lip of the upper jaw, which was carried forward along with the tumor. The whole base of the tumor was covered with a seropurulent exudate of very foul odor. The patient had been working up to the time of his admission to the

hospital His general health was good The tumor had been pronounced inoperable by several surgeons in New York and Boston

In view of the good general condition of the patient, Dr Coley believed that he would be able to stand a radical, although dangerous and necessarily an incomplete operation, and it was decided to do this in two stages Accordingly, a preliminary ligation of both external carotid arteries was done by his associate, Dr William A Downes, on December 16, under novocaine anæsthesia, and three days later, under rectal (ether) anæsthesia administered by Dr Joseph E Lumbard, a total excision of the upper jaw was done by Dr Coley, assisted by Dr Downes Inasmuch as it was impossible to introduce a tube either by mouth or nose, for general anæsthesia, the case seemed to be peculiarly adapted to rectal anæsthesia A bilateral Ferguson incision was made for the removal of the superior maxillæ, the lip and cheek being widely retracted on either side, with the nose drawn upward This gave very good access to the tumor, and with heavy bone forceps the growth, together with the superior maxilla on either side, was removed as far as the orbital plates The tumor extended far back toward the base of the skull, and the posterior portion was merely curetted, considerable tumor tissue necessarily being left behind The operation was done rapidly, and the bleeding, though profuse, was not as severe as had been anticipated, and was readily controlled by packing The nose was then brought down in position, and the facial flaps sutured into place

There was but slight shock following the operation, and the patient made a rapid recovery On December 28, twelve days after the operation, he developed a severe attack of facial erysipelas, his temperature running up to 105° During this attack, a large amount of broken down seropurulent material was discharged On January 8, 1914, after the attack had apparently subsided, he had a severe recurrence lasting four or five days, and extending over the entire face and forehead He finally recovered, and two weeks ago he was put upon the mixed toxins of erysipelas and bacillus prodigiosus in the hope of destroying the remaining portion of the tumor, which it had been impossible to remove, and which had not sloughed out during the attacks of erysipelas

The patient's weight, at the time of his admission to the hospital, was 156 pounds On January 24 it had fallen to 141 pounds, and at the present time, a fortnight later, it was 158 pounds, representing a gain of sixteen pounds He expected to return to work shortly Dr Coley said he intended to have the injections of mixed toxins continued, in small doses, for the next six months

LATERAL ACCESSORY THYROID

The specimen was submitted to Dr James Ewing, who reported that it was a "simple chondroma, not malignant" Dr Coley said that while these cases were regarded as non-malignant, from the histological standpoint, in that they seldom, if ever, produced metastases, they were clinically malignant, inasmuch as they increased in size until they finally destroyed life

LATERAL ACCESSORY THYROID

DR WALTON MARTIN presented a woman, forty-two years old, upon whom he had operated a year ago at St Luke's Hospital For two years preceding the operation the patient had noticed a mass under the sternomastoid muscle, at the level of the angle of the jaw This had never been painful, nor had the overlying skin been red or inflamed There had been no interference with respiration nor deglutition The mass had gradually increased in size

On examination, a movable tumor, oval in shape, could be felt beneath the right sternomastoid, at the level of the angle of the jaw It was about the size of a hen's egg and was not attached to the skin nor underlying tissue Under ether anæsthesia, a transverse incision was made over the mass, the anterior part of the sternomastoid was divided, and the tumor dissected out It was covered by a vascular capsule containing numerous thin-walled veins There was no connection between the tumor and the thyroid gland The mass measured 6 cm in diameter, and on section it appeared to be made up of two portions one had a smooth surface and meaty appearance, the other was lighter in color and more friable

Microscopical examination showed in one part a compact mass of small alveoli lined with a low cuboidal epithelium with large vesicular nuclei The lumina of the alveoli were small, and in some cases obliterated A few contained a small amount of colloid The other section of the tumor showed a more complicated arrangement of the epithelium It was extensively folded, giving a papillomatous appearance to the growth Scattered through this portion were large alveoli filled with colloid

Dr Martin said the case seemed of interest from the view-point of diagnosis, which had not been made at the time of the operation At that time, the tumor was supposed to be a lymphoma The speaker said he believed that a lateral superior accessory thyroid was of uncommon occurrence

DR ARPAD G GERSTER said that cases of accessory thyroid were very rare In his entire experience he had only seen a single instance of this

condition where the diagnosis was verified by autopsy. The patient was a woman, perhaps sixty years old, who developed subcutaneously in the right supraclavicular region, a movable tumor which, after remaining stationary for a long time, began growing rapidly, became adherent to the skin, with perforation and subsequent ulceration. It apparently had no connection with the thyroid gland. Dr. Gerster said he saw the case in company with several other surgeons. Extirpation was out of the question on account of the adhesions to the subjacent vessels. On excising a part of the growth it proved to be an accessory thyroid that had become carcinomatous. This diagnosis was later confirmed at autopsy.

DR. EUGENE H. POOL said that about three years ago (*ANNALS OF SURGERY*, 1910, vol. 11, p. 711) he presented a patient upon whom the late Dr. Frank Hartley had operated for a tumor on the left side of the neck. The growth proved to be a carcinoma springing from an accessory thyroid on the left side, which was in no way connected with the thyroid itself. The latter, with its isthmus, was examined and found to be normal at the time of the operation. The mass in this case was about three inches in length.

BANTI'S DISEASE

DR. JAMES M. HITZROT presented a man, thirty years old, a silk-weaver, who was admitted to the hospital on December 3, 1913. The history he gave was that about sixteen years ago, while living in Armenia, he had several attacks of malaria. Since that time he had suffered from weakness and inability to gain weight, especially during the summer, when his weakness became more pronounced. For a long time he had been aware of the presence of a large spleen, and for a number of years had complained of pains across the upper abdomen, especially in the region of the spleen. About eight years ago he had an attack of jaundice lasting three months. He occasionally complained of headache, his appetite had always been good, and his bowels regular.

On admission, the abdomen was soft and tympanitic; no rigidity nor tenderness. The spleen was enlarged, so that its lower border reached the level of the umbilicus and extended almost to the midline. Its edge was easily palpable, rounded and not tender. It was not hard nor lobulated. The liver was also enlarged, its lower margin in the midclavicular line extending four finger-breadths below the costal margin. In the midline its lower edge was half way between the ensiform and umbilicus. Its edge was smooth and rounded, not tender except over the left lobe below the costal margin.

The spleen was removed December 6, 1913. The patient made a good recovery, and has improved since the operation.

Blood counts. Five blood counts, made during October, 1913, showed the following average: Hæmoglobin, 66 per cent, red blood-cells, 4,873,800, white blood-cells, 6,200, polynuclears, 75 per cent, small mononuclears, 18 per cent, large mononuclears, 7 per cent. On the day before the operation there was 97 per cent of hæmoglobin, red blood-cells, 5,952,000, white blood-cells, 8,700, polynuclears, 77 per cent, small mononuclears, 13 per cent, large mononuclears, 2 per cent, transitionals, 5 per cent, eosinophiles, 3 per cent. These figures remained practically unchanged during December, except for a gradual rise in the number of white cells to 16,500, with a slow recession in the number of white cells through January, and the last blood count, made on February 7, 1914, gave the following result: Hæmoglobin, 96 per cent, red blood-cells, 5,990,000, white blood-cells, 9,800, polynuclears, 62 per cent, small mononuclears, 20 per cent, large mononuclears, 10 per cent, transitionals, 4 per cent, eosinophiles, 2 per cent, basophiles, 2 per cent.

Three Wassermann tests had been made in this case, Dr Hitzrot said, with negative results. The pathological examination of the spleen, made by Dr Esler, confirmed the diagnosis of Banti's disease. The spleen was 19 x 13 x 6 cm and weighed 1 pound and 11 ounces. Its cut surface showed small, dark-red, pinhead spots, like thrombosed vessels, some projecting above the surface, with yellowish, necrotic centres. The Malpighian bodies were not distinctly visible, and the normal arrangement of the stroma was lacking. Some of the vessels were slightly thickened. The consistence of the organ was tough and fairly firm, and in all respects it was identical with that usually encountered in the so-called Banti's spleen. The liver showed distinct evidence of cirrhosis, with perihepatitis. This was the only point of tenderness, and on operation they found quite a number of adhesions. Since the operation, the liver had grown considerably smaller. There were no evidences of malaria, *i e*, parasites in the blood or in the spleen.

HYPERTHYROIDISM CASES ILLUSTRATING POST-OPERATIVE FAILURES

DR JOHN ROGERS showed a series of these cases in connection with his paper on the subject of thyroid disease. The first case was that of a married woman, twenty-eight years old, who came to him in February, 1912, complaining that for four months, following much worry, she had suffered from headaches and nervousness, with weakness and

cardiac palpitation When Dr Rogers first saw her there was severe exophthalmos, with a moderately enlarged, firm goitre The pulse ranged between 130 and 140, there was extreme nervous irritability, with asthenia and emaciation

After medical and serum treatment had been given an unsuccessful trial, the right superior and left inferior thyroid vessels were tied on March 4, 1912, under local anæsthesia, and about ten days later the left superior and right inferior vessels were similarly ligated When the patient left the hospital, on March 30, the pulse ranged between 100 and 120 and the chief improvement that was noted was in an amelioration of the nervous symptoms

In September, 1912, the pulse had fallen to from 80 to 90, and the patient had gained almost 30 pounds in weight Her blood-pressure had fallen from 140 to 120 mm She was still weak, and the exophthalmos was unchanged She was fed with adrenal proteins, which seemed beneficial During the summer of 1913 she suffered much from diarrhoea and asthenia, which was relieved by adrenal feeding The pulse remained between 80 and 90 The nervous irritability had apparently disappeared In the following October there was some exacerbation of her symptoms, and she again improved under adrenal protein feeding

On January 26, 1914, the exophthalmos was unchanged, the pulse ranged between 100 and 110, the goitre was still apparent, the patient suffered from a tremor and asthenia The blood-pressure was 140 mm, weight, 136 pounds She was placed upon a new thyroid extract, given hypodermatically, and under this there had been slow but steady improvement At the present time the exophthalmos was less pronounced, there was no apparent goitre, the pulse ranged between 76 and 85, the blood-pressure was 120 mm There was no tremor and marked improvement in the asthenia

This was a severe type of hyperthyroidism with a small goitre and very pronounced exophthalmos, a combination seldom cured by hemithyroidectomy Quadruple ligation was unsuccessful, but more beneficial than the more radical operation could have been A cure seems really now approaching by the hypodermic administration of this new thyroid product

Dr Rogers's second patient was a married woman, thirty-eight years old, who was first seen in January, 1913, with the typical symptoms of Graves's disease, of three years' duration, following a period of grief and anxiety The exophthalmos was pronounced, and there was a large, symmetrical, pulsating goitre The pulse ranged between 120 and 140, the blood-pressure was 140 mm There was nervous irritability, head-

ache, asthenia and insomnia The patient refused the ligation operation, and on February 13, 1913, the right lobe of the thyroid was excised A severe reaction followed the operation, and there was no noticeable improvement

On January 29, 1914, the exophthalmos was unchanged The left lobe of the thyroid had become hypertrophied since the operation, and was much larger than the original goitre, the neck having increased in size half an inch The blood-pressure at this time was 145 mm The pulse still ranged between 120 and 140 The patient complained of cough, insomnia, asthenia and burning and watering of the eyes

After a tentative trial of thyroid feeding, which intensified all the symptoms, she was put upon the new thyroid extract hypodermatically, and since then there had been a steady improvement in all her symptoms

This illustrates the uncertainty of the radical hemithyroidectomy in a symmetrically enlarged gland, especially when the exophthalmos is pronounced

The next case was that of a married woman, forty-five years old, who, after a period of anxiety and physical fatigue, showed signs of typical, severe exophthalmic goitre in October, 1911 There was slight symmetrical thyroid enlargement, and dyspnoea, palpitation and asthenia were the chief complaints

In November, 1912, the right lobe of the thyroid was removed - This relieved the tachycardia, with the pounding heart, but the patient felt more asthenic, both mentally and physically

On February 4, 1914, there was pronounced exophthalmos, and the left lobe of the thyroid was perceptible The pulse ranged between 120 and 130, blood-pressure, 140 mm The patient weighed 112 pounds There was marked tremor, and mentally the patient was so asthenic that she was unable to read a newspaper or even a single page of a book She spent most of her time in bed and could not walk over one-quarter mile She was put on thyroid feeding, which apparently increased the weakness and tachycardia On February 5, she was put upon the new thyroid extract, hypodermatically, with marked and immediate improvement

This illustrates the uncertainty of the radical operation upon a small symmetrical thyroid enlargement

The next case was that of a married woman, thirty-eight years old, who after having had a small goitre for years, developed, in 1908, severe hyperthyroidism, without exophthalmos During the following year the right lobe of the thyroid was excised, after which the patient made a gradual and complete recovery

In April, 1911, after a period of anxiety, the left lobe of the thyroid became enlarged, and symptoms of hyperthyroidism recurred. On January 18, 1914, when Dr Rogers first saw the patient, the left lobe of the thyroid was moderately enlarged. There was no exophthalmos. The pulse ranged between 140 and 150, with a blood-pressure of 170 mm. The patient weighed 124 pounds and her neck measurement was 14½ inches. She was extremely nervous and irritable, with asthenia, the symptoms being typical of a severe form of relapsing hyperthyroidism. On January 20, 1914, she was placed upon the new extract of thyroid, given hypodermatically, with a rapid, pronounced improvement in all the symptoms. On February 11, the thyroid was imperceptible, the measurement of the neck having decreased by one inch. Pulse now ranged between 80 and 90, blood-pressure between 140 and 150. Patient had gained 3 pounds and her nervous irritability had entirely gone.

This case is an example of the uncertainties in radical hemithyroidectomy for small symmetrical goitres, with hyperthyroidism and pronounced nervous irritability.

The next case was that of an unmarried woman, forty-four years old, who, when she was first seen, in June, 1910, gave a history of goitre of twenty years' standing. At that time she was teaching school and had "nervous prostration," accompanied by rapid pulse. She recovered from this attack and subsequently entered a training school for nurses, where she again developed symptoms of hyperthyroidism, which disappeared under rest.

In January, 1910, after a period of strenuous exertion, she began to be nervous and grow stout and suffer from palpitation, with frequent headaches (alternating hypo- and hyperthyroidism). In June, 1910 when Dr Rogers first saw her, there was a large, multiple cystic goitre. No exophthalmos. The pulse ranged between 100 and 120, the blood-pressure was 170 mm. The patient was stout and well nourished, and complained of insomnia, headaches and asthenia. On June 25, 1910, both superior thyroid vessels were ligated. No appreciable improvement resulted. On August 15, the gland was exposed and many large adenomata shelled out of both lobes. This included, practically, all of the left lobe. There was no noticeable improvement after this operation. The patient spent most of her time in bed, suffering from mental and physical asthenia, with tachycardia and headaches.

In December, 1913, the pulse ranged between 110 and 130, the blood-pressure was 220 mm, and the patient still complained of insomnia, headaches and asthenia. On February 11, 1914, after the use of the

new thyroid extract, hypodermatically, the pulse had fallen from 60 to 80, the blood-pressure to 160 mm, the patient was up and about six hours daily, and her headaches had entirely disappeared. This case represented a single hyperthyroidism grafted upon a goitre of long standing. The high blood was the only sign which might counterindicate the hemithyroidectomy.

The next case was that of a married woman, twenty-four years old, who was first seen in November, 1910, with a typical exophthalmic goitre of two months' duration, which came on after a period of great mental and physical fatigue. She was given antithyroid serum without benefit. There was pronounced exophthalmos, with a large, pulsating goitre. The pulse ranged between 130 and 150, the blood-pressure was 120 mm. Tonsils enlarged and there was a history of frequent tonsillitis.

On December 6, 1910, both superior thyroid vessels were tied under ether. The tonsils were removed at the same time. After this there was a gradual recovery, except that the goitre remained unchanged, and in May, 1912, the patient considered herself cured and took a course in nursing, under which she had a relapse, and two months later she again showed all the typical symptoms of exophthalmic goitre. On August 6, 1912, both inferior thyroid arteries were tied under novocaine, after this she made a perfect recovery, a small, soft goitre alone remaining.

In January, 1913, after spending two weeks in a nurses' training school, she had another relapse, but no exophthalmos. She made a partial recovery after three months' rest and resumed her work. In May, 1913, after an attack of scarlatina, she again relapsed and went to her home in Holland, where the right lobe of the thyroid was removed. After this she made a gradual but apparently complete recovery. She increased in weight, her pulse was 80, the blood-pressure 125 mm, and no goitre nor exophthalmos could be made out.

On February 5, 1914, after spending two weeks at the nurses' school, she again developed the typical symptoms of hyperthyroidism, with a perceptible goitre on the left side, a pulse ranging between 115 and 120 and a blood-pressure of 140 mm. She was then put upon the new thyroid extract, hypodermatically, with immediate improvement.

This was a case of quadruple ligation of the thyroid vessels with apparent cure and subsequent relapse—again cured by hemithyroidectomy. Later, after resuming work, relapse again took place—apparently the hemithyroidectomy was no more of a safeguard than the quadruple ligation.

The last patient shown by Dr. Rogers was a clergyman, forty-four

years old, who came under his observation in April, 1913, with the typical symptoms of exophthalmic goitre, which began about three years ago with insomnia and headaches (hypothyroidism), followed by nervousness and palpitation (hyperthyroidism) and finally by marked exophthalmos, which was then of two months' duration. He had a firm goitre, perhaps four times the normal size of the gland. The pulse ranged between 100 and 120, the blood-pressure between 140 and 160 mm. The patient was extremely nervous and tremulous, and showed evidence of emaciation.

On April 24, 1913, the left inferior thyroid artery was tied under local anæsthesia. Two days later the right inferior and right superior vessels were similarly tied, and on April 30 the left superior artery was ligated. Following these operations, the pulse fell to 80 and the blood-pressure to 130 mm, but the exophthalmos and asthenia were still pronounced and the tremulous condition remained unchanged. By October, 1913, he had gained 20 pounds in weight, but complained of nervousness and insomnia. At this time he was taking adrenal proteins by which alone, apparently, the weight was maintained. When the adrenal feeding was stopped loss of weight followed. On January 15, 1914, his condition was practically the same, and he was put upon ferrous iodide. There was some improvement in his symptoms, but the goitre remained hard and firm, which pointed to ultimate failure. On February 2 he was put on the new thyroid extract, hypodermatically, with marked improvement. The pulse fell to 80, the blood-pressure was 150 mm, and his nervousness largely disappeared. On February 11 there was no perceptible exophthalmos nor goitre, the pulse was 72, the blood-pressure had fallen to 130 mm, the patient was gaining in weight, and showed no apparent abnormality excepting slight asthenia.

This typical exophthalmic goitre was apparently cured of the hyperthyroid symptoms by the quadruple ligation operation, but asthenia and the nervous irritability remained. Iodine feeding and the new thyroid preparation by hypodermic seem to have relieved the asthenia and nervousness. It is one of the few instances Dr. Rogers has seen, and then always in male subjects, in which iodine was beneficial for hyperthyroidism. It should be noted that there was no tachycardia when the iodine was begun.

THE COURSE OF THYROID DISEASE, AND THE GENERAL PRINCIPLES WHICH SEEM TO CONTROL ITS PROGRESS

DR. JOHN ROGERS read a paper with the above title, for which see page 281.

GASTROTOMY IN AN INFANT

Stated Meeting, held at St Luke's Hospital, February 25, 1914

The President, DR FREDERIC KAMMERER, in the Chair

IDIOPATHIC PERITONITIS, PROBABLY OF PNEUMOCOCCUS ORIGIN

DR NATHAN W. GREEN presented a girl, six years old, a patient of Dr Thomas F. Quinlan, who was admitted to St Luke's Hospital on January 2, 1914, complaining of pain in the abdomen. Her symptoms began three days before admission with pain and tenderness over the abdomen, nausea, vomiting and fever. On the second day of her illness, there had been an apparent remission of the symptoms, which again became aggravated on the day of her admission. There was no history of any immediate previous infection, no aural discharge nor pain. Her past history was negative and the family history was good.

Upon admission, the child's temperature was 103.4° , pulse, 130. Physical examination showed a well-developed child, with very little distention of the abdomen, but with tenderness on palpation, most marked below the umbilicus in the region of the midline. There was no marked rigidity, and pressure on the abdomen was not excessively painful. No abdominal masses were felt. The leucocyte count gave no definite information. Operation revealed a diffuse peritonitis, but the appendix was found to be normal and there was no apparent site of entry of the infection. There was no evidence of ulceration of the stomach or intestines. The pelvis was filled with a seropurulent exudate, and the intestines were much injected and covered in spots with lymph. Two rubber dam drains were inserted, and the patient was returned to the ward. A smear from the peritonitis showed a large Gram-positive coccus in chains.

A few weeks after the operation, and apparently consecutive with it, a mass developed in the left inguinal region, the temperature and pulse remaining somewhat elevated. On January 30, 1914, this mass was opened and drained, and a culture from its contents showed an encapsulated Gram-positive coccus in pairs and short chains. Recovery from this second operation was uneventful, and the patient was discharged 27 days later.

GASTROTOMY IN AN INFANT

DR GREEN presented the patient who was admitted to St Luke's Hospital June 6, 1913, with the history of having swallowed an open safety-pin. During an attempt that had been made to remove this, the top had been broken off, leaving two sharp, outstanding points. An

X-ray was taken, which showed the pin in the upper part of the œsophagus. With the œsophagoscope, an attempt was made to extract the pin, but this failing, it was pushed down into the stomach, where it was again located by means of the X-ray, which clearly outlined the two outstanding points. A gastrotomy was done by the simple procedure of feeling the pin within the stomach and pushing it out, enlarging the opening for the coiled part of the pin. The opening in the stomach was then closed with a double suture and the child made an uneventful recovery.

EPITHELIOMA OF THE PENIS TOTAL ABLATION, WITH
DISSECTION OF THE INGUINAL GLANDS NO
RECURRENCE AFTER FIVE YEARS

DR GREEN presented a man sixty-seven years old, who was referred to him by Dr Howard Fox in January, 1909. The condition at that time was an almost complete erosion of the glans penis, which pathologically had been pronounced a prickly-celled epithelioma.

The patient was operated on by Dr Green in January, 1909, removing the crura back to their insertion into the ischium, together with bilateral castration and the insertion of the stump of the corpus spongiosum and the urethra into a button-hole made in the skin of the perineum. The inguinal lymphatics were also removed. There was some delay in the healing of the wound on account of what appeared to be a local necrosis in some of the deep fascial structures. This eventually cleared up, and five years had now elapsed without any signs of recurrence. Microscopically, the growth proved to be a basal-celled epithelioma. The inguinal nodes were not involved.

Dr Green said that in a future operation of this kind he thought it would be preferable to split the scrotum sagittally, and insert the urethra into the posterior angle of the wound thus made. In this case, the button-hole opening made in the perineum showed a tendency to contract.

RESECTION OF THE HEAD OF THE ULNA FOR ANTERIOR
DISPLACEMENT ACCOMPANYING UNREDUCED
COLLES'S FRACTURE

DR DOUGLAS presented a man, forty years old, a machinist, who came under observation on July 21, 1913, suffering from a fracture of the lower end of the right radius, with an accompanying anterior displacement of the head of the ulna. The injury was of two months' duration, and the arm had been put up in a plaster case.

ACTINOMYCOTIC SUBPHRENIC ABSCESS

Examination showed a slight silver-fork deformity, with the head of the ulna displaced anteriorly. A radiograph was made, which showed the head of the ulna impinging on the carpus, producing considerable limitation of motion. The hand was in the position of supination, and there was almost complete loss of pronation. Flexion was limited to 160 degrees, extension was slightly limited.

Operation. On August 15, 1913, Dr Douglas excised about an inch of the lower end of the ulna subperiosteally. The patient left the hospital a week later, and his recovery was uneventful. At the present time there was very little deformity, pronation and supination were normal, flexion was slightly limited and there was good function in the hand and wrist.

ACTINOMYCOTIC SUBPHRENIC ABSCESS

DR JOHN DOUGLAS presented a woman, fifty years old, a Canadian by birth. She was married and had had two miscarriages, no children. The history she gave was that for five years she had suffered from a hacking cough. Her sputum had been examined for tubercle bacilli, with negative results. Several years ago she had a phlebitis of the left leg, and two years ago she began to suffer from pain in the left knee. Last summer, while in Baltimore, this pain became more severe, where, on July 4, 1913, she was operated on for a "hypertrophic arthritis." No pus was found, but following the operation she had a second attack of phlebitis and her general convalescence was stormy. She had severe pain, which she referred to the upper abdomen, especially the right hypochondrium, and remained in the hospital for two months.

After returning to her home in New Jersey she continued to have an irregular temperature, which sometimes went as high as 104.5°. She also had a dry, hacking cough, with pain under the left costal arch. When Dr J F Bell first saw her, in November, 1913, the cough and pain persisted, with a temperature ranging between 101 and 104°, and night sweats. The pulse rarely went above 100 and the respirations were below 28.

A physical examination at this time showed nothing but dulness and diminished breathing and voice sounds over a small area at the base of the left lung, posteriorly. There were no râles, no expectoration. A blood count showed a slight increase in the leucocytes (13,100), with 86 per cent of polynuclears. Subsequently, the blood showed 26,000 leucocytes, with 70 per cent of polynuclears. The patient had lost twenty pounds in weight since the preceding July. A radiograph showed no distinct shadow, but the arch of the diaphragm was slightly higher.

than normal on the left side, and fluoroscopic examination showed diminished excursion of the diaphragm. After several attempts at exploration with the needle, pus was found by Dr E Libman, who saw the case in consultation, but it was not determined whether it came from above or below the diaphragm. This pus was sterile on examination by smear and culture. On November 19 the blood showed 10,000 leucocytes, with 65 per cent of polynuclears. The patient's temperature at this time was 103.5°, pulse, 88; respirations, 26.

On November 25, 1913, under local anæsthesia, Dr Douglas resected about an inch and a half of the tenth rib in the postaxillary line. Upon reflecting the pleura upward, the diaphragm was found to be thickened, indurated and inflamed, and pus was obtained with the needle from below the diaphragm. The latter was therefore incised, opening into an abscess cavity containing about an ounce of pus. A small section of the wall of the cavity was removed for examination. The pus was found to be sterile, but an examination of the section showed the presence of actinomycetes.

The temperature gradually fell after the operation, and the patient left the hospital on the sixteenth day. She was given potassium iodide, fifteen grains three times a day. She now has no temperature and the wound has almost healed, except for a small superficial area.

This case was shown, Dr Douglas said, because of the rarity of abdominal actinomycosis. According to Frazier, in *Keen's Surgery*, 71 per cent of these cases were fatal. Frazier also made the statement that from 50 to 60 per cent of all the abdominal cases originated in the region of the cæcum, and that all cases of abdominal actinomycosis originated in the gastro-intestinal tract. Both Mayo Robson and Trinkler have reported cases of primary actinomycosis of the stomach. Mayo Robson's case died, while that of Trinkler recovered. Pohl, in the *Zeitschr f Chir*, September, 1912, reports one case and was only able to find reports of four other cases, three of which he considers doubtful. In this case, Dr Douglas said, the origin of the infection could be only a matter of speculation.

HOURLY CONTRACTION OF THE STOMACH FIVE CASES

DR WILLIAM A DOWNES said that in presenting these patients he wished to emphasize the fact that in no case were the X-ray findings alone accepted as the indications for operation. The usual laboratory and bed-side tests were made in all of the cases excepting those procedures which seemed to be contra-indicated on account of the presence of acute symptoms. The results of those examinations had been

omitted from this report for the sake of brevity. The reason for these remarks was the fact that all surgeons appreciated how frequently spasm of the stomach had given rise to pseudo-hour-glass contraction, and in the earlier cases had occasionally led to unnecessary operation.

These five cases, together with a sixth more recent case, which would be referred to and the X-ray findings of which would be shown, illustrated the various types of operation which were suitable for the condition under discussion.

In the first two cases, gastro-enterostomy seemed unquestionably the proper procedure, as it met the indications *viz.*, the ulcers were healed, the pylorus was patent, the distal pouch was perfectly able to empty itself, while the cardiac pouch was sufficiently large to permit of the anastomosis.

In the third case the ulcer was an active one and was so situated that it seemed wisest to attempt its removal. In the presence of a patent pylorus, therefore, an excision was done, with gastropasty. That this corrected the deformity only in part was shown by the subsequent X-ray. This case would be followed with interest because of the fact that in many instances these contractions tended to recur after plastic operations of this type.

In the fourth and fifth cases gastrostomy was performed, as the conditions seemed to be best met by the use of this procedure. The two pouches, which were of nearly equal size, were united by very large openings, so situated that practically the continuity of the greater curvature was restored. In both instances the pylorus was open, and the stomach, at the site of the healed ulcer, was adherent to the under surface of the liver by dense adhesions which it seemed unwise to separate.

In the sixth case a complete resection of the middle segment of the stomach, including the ulcer, was done, with circular suture of the remaining portion of the stomach, namely, a mediogastric resection. Convalescence up to this time, ten days after operation, had been uninterrupted.

CASE I.—This patient was a girl of fourteen, who was admitted to St. Luke's Hospital on June 6, 1913, with a history of vomiting and loss of flesh. At the time of her admission her weight was 50 pounds, she was vomiting all solid food and for several months had been able to retain only milk and raw eggs. The blood showed 58 per cent of hæmoglobin. The Wassermann reaction was highly positive. An X-ray examination showed the stomach to

be remarkably distorted, and divided into two pouches. Of these, the larger was the cardiac, which represented one-third the size of the normal stomach. A narrow, tortuous channel connected this pouch with the pyloric, which was very small.

On account of the extreme emaciation and almost complete obstruction, an immediate operation was advised, with the intention of beginning specific treatment as soon as convalescence was established. Consequently, on June 12, a posterior gastro-enterostomy was done. The jejunum was united to the cardiac pouch with considerable difficulty. At the time of the operation it was found that the right half of the stomach, with the exception of a very narrow channel along the lesser curvature leading to a small pouch at the pylorus, had been changed into a cicatricial mass.

Feeding was begun twelve hours after operation, commencing with small quantities of clear broth and water. Convalescence was uninterrupted, no vomiting taking place until the tenth day. By that time the amount of food had been increased from six to eight ounces at each feeding. The recurrence of vomiting was puzzling, and was only explained after the taking of another series of X-ray pictures, when it was observed that an eight-ounce bismuth meal not only produced distention of the cardiac pouch, but also marked dilatation of the lower œsophagus, indicating that there was an effort on the part of the œsophagus to compensate for the reduced size of the stomach, and the vomiting was more in the nature of regurgitation. After the quantity of food was reduced to four ounces, the vomiting ceased and the patient went on to recovery. Mixed treatment and salvarsan was begun two weeks after operation and continued up to the present time.

While the patient had gained only a few pounds in weight, she was now able to eat all kinds of food, and felt practically well. The X-ray showed that all the food now passed through the new opening.

CASE II—The patient was a woman of fifty, who was admitted to the hospital on August 29, 1913, complaining chiefly of pain in the epigastrium, with vomiting after meals. This condition had been more or less acute for the past five months, and dated back, intermittently, for a period of twenty years. During that time she had been treated in various hospitals for stomach and gall-bladder trouble, and five years ago she was operated on for suspected gall-stones, which were not found, and she remained unrelieved. The patient was poorly nourished.

An X-ray was taken which showed the stomach to be divided into two compartments of about equal size. The pylorus was

patent, and the distal pouch was emptied in the normal time limit. There was, however, considerable retention in the upper pouch at the end of six hours.

On operation, which was done on September 15, a marked degree of hour-glass contraction of the stomach was found. A mass of omentum was caught up over the middle of the stomach, and was adherent to the lesser curvature and the under surface of the liver. This omental adhesion was divided, and the channel connecting the two pouches was found to be very tight, scarcely admitting the tip of the finger. The cardiac pouch was readily brought into the wound, rendering it quite easy to perform a posterior gastro-enterostomy, which seemed to cover the indications in this case.

CASE III.—The patient was a woman, thirty-four years old, who was admitted to the hospital on October 15, 1913, complaining chiefly of pain in the epigastric region. This pain came on directly after eating, it persisted for about an hour and radiated to the left shoulder. Recently, even the ingestion of milk or water had brought on the pain. She had had occasional spells of vomiting, and at times the vomitus contained blood. This condition extended back for a period of eighteen years, although the acute symptoms were present for only six or eight weeks. The patient was much emaciated, weighing about 110 pounds.

The X-ray showed a penetrating ulcer about the size of a ten-cent piece, situated near the centre of the lesser curvature, with a constriction of the stomach dividing it. This constriction was not regarded as having any special bearing on the clinical features of the case, as both pouches were emptied within the normal limit of time. The operative indications were those of an active ulcer.

Operation, October 21. The ulcer was excised by removing an elliptical portion of the lesser curvature running in the long axis of the stomach, and suturing the rent thus made in the opposite direction, that is, the line of suture running at right angles to the incision. In this way it was hoped to overcome the tendency toward the development of stricture.

The patient's convalescence was uneventful, but an X-ray picture, taken two weeks after operation, showed there was still a tendency to contraction. The channel connecting the two pouches appeared to be about trebled in width by the operation, that is, increased from one to three inches.

In this case, Dr. Downes said, there was some danger that the scar might become adherent posteriorly and to the under surface of the liver, with a resulting contraction of the stomach. For that reason it might have been expedient to add a gastro-enter-

ostomy However, the operation was a long and tedious one, and he felt that by keeping the patient under observation he might be able to do the second operation should it become necessary At the present time the patient was in better health than she had been for years, she had gained much weight and was able to eat almost anything

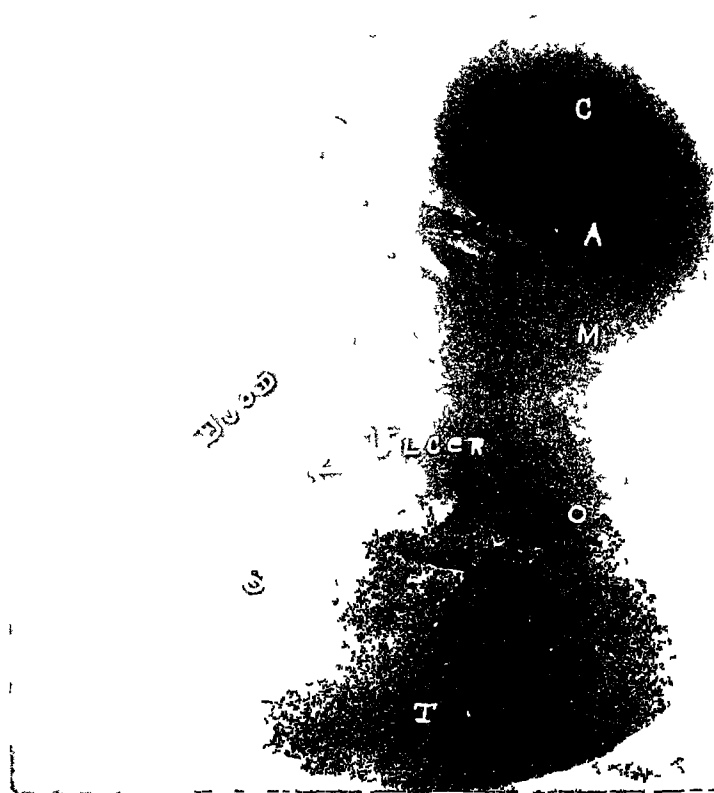
CASE IV—The patient was a woman, forty-five years old, who was admitted to the hospital on January 4, 1914, with the history of pain and a burning sensation in the stomach, usually coming on an hour after eating This pain was relieved by vomiting The appearance of the patient led to the suspicion of malignant disease She had lost much flesh and showed a distinct pallor She was the mother of eight children, and had a marked diastasis of the recti muscles

The X-ray in this case showed the stomach to be divided into two pouches of almost equal size, with a very small channel connecting the two There was considerable retention in the upper pouch after the ingestion of a bismuth meal In one of the series of pictures there was also retention in the lower or pyloric pouch, which suggested obstruction at the pylorus However, in a subsequent series, this pouch entirely emptied itself, and the previous retention was attributed to a spasm of the pylorus

At operation, a marked hour-glass contraction was found It occupied the middle of the stomach, and was apparently the result of a healed ulcer The pylorus easily admitted the end of the thumb The adhesions between the lesser curvature and the under surface of the liver were very extensive, and it seemed unwise to separate them The two pouches were easily brought together, and were so placed as to unite them at their most dependent point, thus restoring the continuity of the greater curvature of the stomach

The patient made a satisfactory recovery, and a series of X-ray plates, taken three weeks after the operation, showed that the stomach was readily emptying itself, and that the patient's condition was apparently entirely relieved

CASE V—This patient was shown to illustrate a late result in a case of hour-glass contraction which had been operated on by Dr Downes in December, 1908 In this case, which had already been reported at a previous meeting of the Society, the conditions resembled somewhat those found in Case IV A gastro-gastrostomy was done Since the operation, the patient had gained 40 pounds in weight, she was able to perform her usual duties, which were those of a house-maid, she was free from all pain and discomfort, and was able to eat all sorts of food



Before operation Multiple ulcers of stomach

FIG 2



After operation Excision of stomach gastro-enterostomy

CARCINOMA OF THE CÆCUM

CARCINOMA OF THE STOMACH GRAFTED ON AN ULCER BASE

DR. FRANK S MATHEWS showed a man, sixty years old, on whom he did a partial gastrectomy seven months ago. The stomach had a normal acidity, and in consequence a diagnosis of ulcer had been made. The stomach showed two large, deeply excavated and indurated ulcers, and considering the patient's age and the appearance of the ulcers, Dr Mathews treated the case as one of carcinoma. The original pathological report was ulcer, but subsequently undoubted carcinoma was found in the associated lymph-nodes, after which a second search revealed carcinoma in the wall of the ulcer.

Too much dependence, the speaker said, should not be placed on a normal acid finding in a stomach. This case was the type of stomach cancer that had an excellent chance for cure. This patient left the hospital in the third week, and had gained thirty pounds in weight since the operation.

The X-ray pictures were made by Dr Le Wald before and after operation.

DR KAMMERER recalled a similar experience where he did a resection for a tumor of the stomach. The growth seemed to be of inflammatory origin, and pathologically it was reported to be benign. Some adjacent enlarged glands that had been removed at the time of the operation were then examined and at one point showed evidences of malignancy, and subsequently, after many sections were examined, carcinomatous areas were also found in the original growth. Such cases showed the importance of making many sections of suspicious tumors in this region, lest their possible malignant nature should be overlooked.

CARCINOMA OF THE CÆCUM, WITH OBSTRUCTION

DR MATHEWS presented a man, fifty-five years old, who was admitted to the hospital with signs of incomplete intestinal obstruction. At operation, the obstruction was found in the lower portion of the ileum, where it was adherent to a carcinoma in the ascending colon. In exploring the growths, a perforation occurred in the friable wall of the ileum, with discharging of intestinal contents. The ascending colon and the lower two feet of the ileum were removed, and the continuity of the gut restored by lateral anastomosis. No leakage followed, but there was severe wound infection, the result of soiling with intestinal contents. Dr Mathews said that this complication, which he had also seen occur with fatal results in a second similar case, emphasized the importance of handling these growths with great care in order to avoid

injury, and in future he would be content to do an anastomosis around the growth, subsequently doing a resection in the absence of obstruction. It was difficult to avoid soiling and some infection when resections were done in the presence of obstruction.

This patient had gained 45 pounds in weight since the operation, eight months ago, but there were now signs of recurrence in the wound.

SARCOMA OF THE MESOSIGMOID

DR MATHEWS presented a patient, a woman of fifty-five, who was admitted to the hospital with a pelvic tumor which was thought to be a fibroid, with adherent intestine. A growth double the size of an adult fist was found in the mesosigmoid, and adherent to the bladder. A resection of twelve inches of sigmoid was made, with end-to-end anastomosis. Following the operation, a fecal fistula persisted for several weeks. The growth proved to be a circumscribed spindle-celled sarcoma lying in the mesentery, but intimately related to the wall of the gut and probably originating from it.

This patient had gained twenty pounds in weight since the operation, six months ago. Because of the involvement of the bladder wall, a recurrence might be confidently expected.

ANNULAR CARCINOMA OF THE PELVIC COLON

DR MATHEWS presented a woman, forty-two years old, upon whom he operated five months ago for a carcinoma just above the pelvic floor. A segment of the gut was removed, together with some enlarged glands in the hollow of the sacrum. The latter showed no malignant involvement. It would have been well-nigh impossible in this case, the speaker said, to make a suture restoring the gut on the pelvic floor, hence a very large rubber drainage tube was inserted in the oral segment, and the gut was inverted about it, as was usually done with a tube in the gall-bladder. Sutures were then placed in the outer coats of the gut, attaching it to the rubber tube. When this was done, only peritoneum was exposed. The tube was then passed into the lower segment of the gut and out at the anus. A number of sutures were then placed around the tube, uniting the two segments of gut. Finally, by traction on the protruding end of the tube, the anastomosis was drawn down snugly on to the pelvic floor, and the upper segment partly invaginated into the lower. The tube came out on the eighth day, and the bowels moved on the following day. There was primary

FIG 3



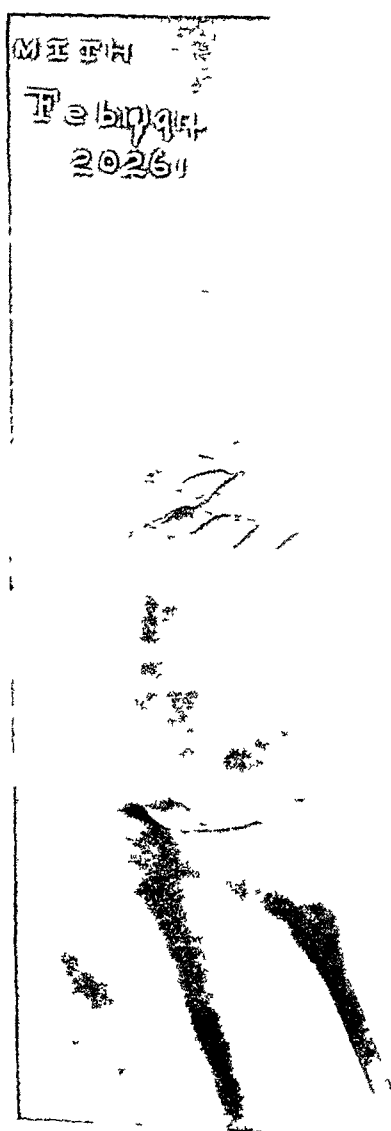
One month old fracture of the lower third of femur Two and one-half inches shortening

FIG 4



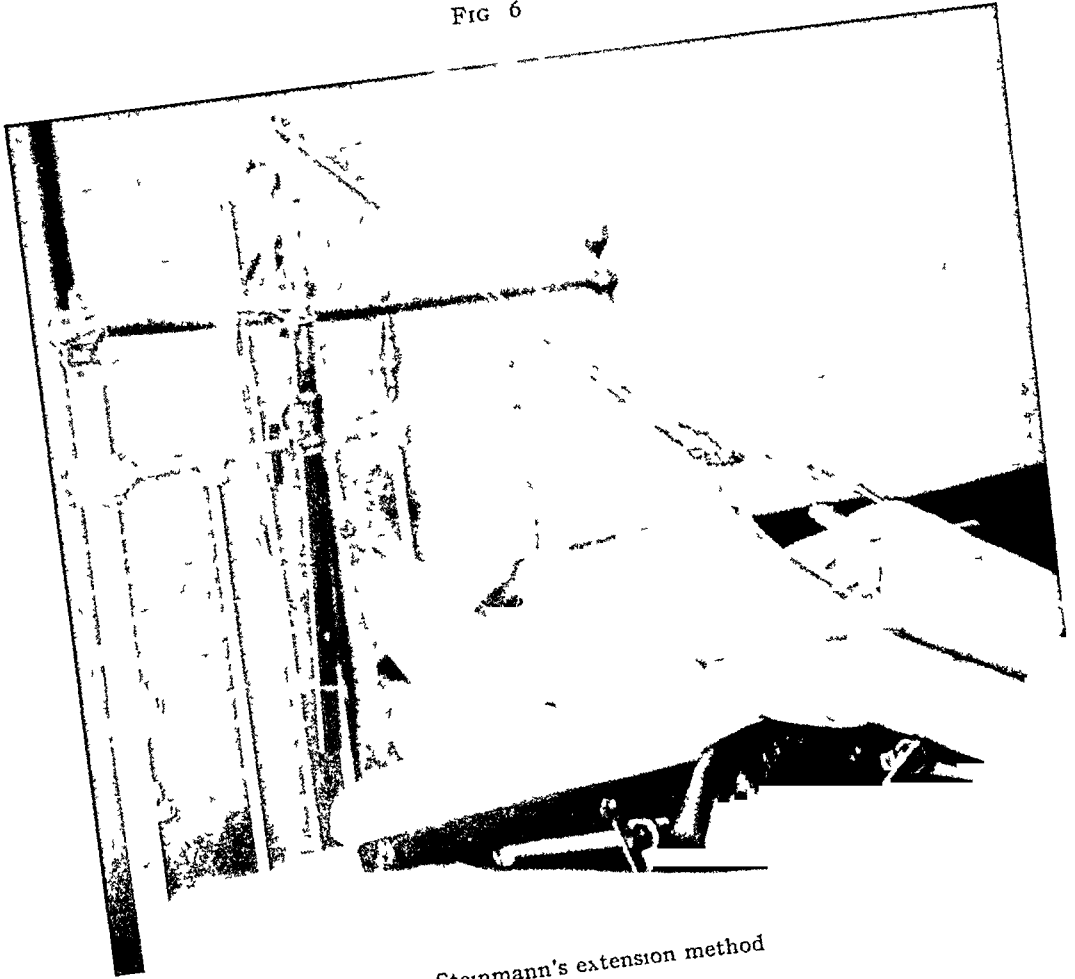
The same after ten days of traction with twenty-six pounds

FIG 5



Thirty days later Deformity corrected Actual lengthening of one-half inch Note
callus on posterior aspect

FIG 6



Steinmann's extension method

union, the patient was out of bed on the twelfth day and was discharged within three weeks. Since the operation she had gained considerable weight, she looked well, and there were no evidences of cicatricial contraction at the point of anastomosis.

STEINMANN'S NAIL EXTENSION METHOD IN FRACTURES

DR H H M LYLE presented three such cases. The first was that of a fracture of the lower third of the femur, of one month's standing, with two and a half inches shortening. The patient was a man, thirty-five years old, who had sustained a transverse fracture of the lower third of the left femur, and a comminuted fracture of the left tibia. The patient had been under treatment for a month in another hospital, the treatment having consisted in the use of traction (15 pounds) and an inclined plane.

On admission to St. Luke's Hospital the patient had a marked lateral and anteroposterior deformity, with two and a half inches shortening. The exact conditions were represented in the accompanying X-ray plate (Fig 3).

On January 12, 1914, a Steinmann nail was inserted through the lower end of the femur, a 26-pound weight was applied, and the limb placed on a Zuppinger splint, the angle at the knee being 135 degrees. Ten days later the lateral deformity was overcome, and the shortening had been reduced to half an inch (Fig 4). Twenty-seven days later the actual shortening was half an inch. Attempts to correct the posterior displacement having failed, an open operation was done. The complete reduction of the fragments was prevented by the interposition of a small portion of muscle tissue, and on removing this the bones readily slipped into place (Fig 5).

The Steinmann pins were used for 43 days, seventeen days preceding the open operation and 26 days afterward. They gave rise to no pain nor discomfort (Fig 6).

Dr Lyle's second case was one of compound, comminuted fracture of the tibia and fibula treated by a Steinmann pin inserted through the os calcis.

The patient was a woman, thirty-six years old, weighing 240 pounds, who had sustained a compound, comminuted fracture of the left tibia and fibula. On examination, both bones were found projecting through the skin. The patient was immediately taken to the operating room, the wounds were disinfected and the fragments reduced. A Steinmann pin was inserted through the os calcis, and ten pounds of traction

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maintained for nineteen days The weight was then removed and moulded plaster splints applied

Dr Lyle's third case was one of infected, compound, comminuted fracture of the left tibia and fibula

The patient was a man, forty-seven years old, who had sustained a severe compound, comminuted fracture of the left tibia and fibula On admission to the hospital, the lower ends of the upper fragments were projecting through the skin, and a loose portion of the fibula, two inches in length, was protruding through a separate posterior wound The wound was infected

After disinfection of the wounds, the loose fragment was removed and bridge-plaster splints were applied The loss of bone and the spreading infection made it impossible to maintain anything like the correct position of the limb, and the dressings were difficult and extremely painful Ten days of hiccupping, combined with the infection and pain, made the patient's condition distressing It was finally decided to remove the splints, pass a Steinmann pin through the os calcis and establish traction This was done, and a 15-pound weight applied With this, the pain ceased, there was better drainage, dressing was made easier, and within three days the hiccupping was controlled The loss of the portion of the fibula necessitated the continuation of traction for two months

said, four cardinal points must not pass through the joint nor the epiphyseal

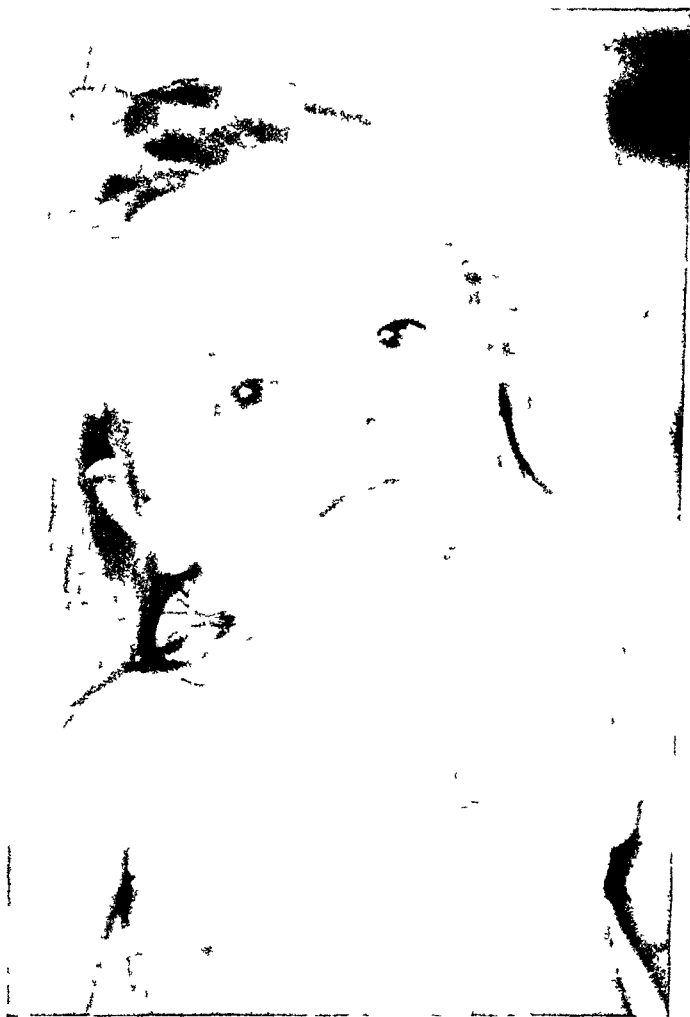
value of this method of deformities re-

The above cases were presented to show the value of inserting the Steinmann pin, the pin in fracture to be kept in mind, namely the pin in fracture hæmatoma, the medullary canal, the line

in compound fractures, and in the late correction resulting from badly treated fractures

Dr LYLE presented a child, twenty months of age, with a large, multilocular, pyriform, cystic swelling of the neck. The parents were six of whom had died in infancy. The child had a small swelling of a walnut, since birth, and this had recently, when, after a superficial inflammation, it had attained its present size until it had attained its present size. On admission to Dr Lyle's service, a large, multilocular, pyriform, cystic swelling, posteriorly to within one in

FIG 7



Cystic hygroma of neck Child twenty months old

UNUNITED FRACTURE OF THE CLAVICLE

of the jaw and the mastoid, while below it passed over the clavicle. The central skin showed a superficial inflammatory patch the size of the palm of the hand. There was an impulse on coughing. The left pupil was slightly contracted. The X-ray showed an indefinite shadow behind the sternum. Both the Wassermann and von Pirquet tests were negative (Fig 7).

On account of the inflamed condition of the skin, operation was postponed for two months, and during this period the tumor steadily increased in size. At operation a large cystic, multilocular hygroma was excised. The tumor had burrowed between the deep muscles of the neck, had crossed the median line to the anterior border of the opposite sternomastoid, and passed downward behind the sternum for a distance of two inches. Pathological examination proved it to be a multilocular cyst lined with endothelium. The patient made an uneventful recovery.

Dr Lyle said that Dr Charles N Dowd had presented two examples of this type of tumor to the Society, and had reported four. Dr Downes and Dr Mathews had also shown cases, the former an extensive hygroma of the axilla and the latter a hygroma of the neck.

DR CHARLES N DOWD said he was chiefly interested in the comparative frequency with which these cases of hygroma were now being reported. When he operated upon his first patient a year and a half ago, he was unable to find any one who had seen a similar case, but since that time several cases had been reported. It was highly important that a prompt nitrate of silver stain of the wall of the cyst should be made, so as to determine the character of its lining.

UNUNITED FRACTURE OF THE CLAVICLE OF ONE YEAR'S STANDING, TREATED WITH A BONE GRAFT AND BLOOD INJECTIONS

DR LYLE presented a sailor, thirty-three years old, who sustained a fracture of the clavicle fourteen months ago. He had been treated for this in a hospital in England for four weeks, and afterward for seven weeks as an outpatient. When he came to St Luke's Hospital he complained of restricted motion and loss of power in the left shoulder. Examination revealed an old, ununited fracture at the junction of the middle and outer thirds of the left clavicle. The inner fragment was displaced above the outer, and both were freely movable.

At operation, after freeing the ends, they were freshened and brought into apposition. A bone graft, 6 by 1.5 cm, was removed from the left tibia and applied as a splint to the clavicle. The graft was

fastened in place by kangaroo tendon sutures passed through the graft and clavicle. Twenty-seven days after the operation, the graft, having become displaced upward and producing a pressure necrosis on the skin, was removed. It was smooth and clean and apparently viable, indicating that bone regeneration had already begun. The extension wound healed in a few days, and a week later blood injections, according to the Bier method, were begun. From fifteen to twenty cubic centimetres of blood were given weekly for four weeks. The patient now had perfect functional use of the arm and shoulder. The shoulder was strong, and there was bony union.

Dr Lyle said that in this situation, where the soft parts were thin and it was hard to secure immobilization, a bone graft should not be used as a splint, but rather as a means of stimulating bone growth. This was the chief therapeutic value of the graft. The speaker said he had obtained better results from the use of thin bone grafts than from thick ones, and he had found that blood injections were valuable in stimulating latent osteogenesis.

HÆMOLYTIC JAUNDICE WITH CHOLELITHIASIS

DR WALTON MARTIN presented a woman, twenty-one years old, who had been referred from the medical division of the hospital on December 8, 1912, for splenectomy for hæmolytic jaundice. She showed the characteristic features of this interesting symptom-complex, *i.e.*, slight jaundice, enlargement of the spleen, recurrent attacks of abdominal pain, with moderate anæmia. A blood examination gave 3,200,000 red cells, 6500 white cells and 65 per cent of hæmoglobin, with increased fragility and reticulation of the red cells. The urine was free from bile and the stools were normal in color. The patient was well nourished and did not look ill. The symptoms she gave dated back about three years.

On opening the abdomen in the middle line the spleen was found slightly enlarged, with a few adhesions between it and the diaphragm. The gall-bladder, which was small, was filled with thickened bile and contained three large calculi and many small ones. The gall-bladder was incised, the stones removed and a drainage tube inserted. When the patient left the hospital, a month later, the gall-bladder sinus had closed.

About three weeks later she was re-admitted suffering from violent epigastric pain, with rigidity and tenderness over the upper abdomen and the feeling of a mass beneath the incision of her former operation. On January 30, 1913, the old cicatrix was excised and the gall-bladder

CARCINOMA OF THE GALL-BLADDER

exposed, freed from its numerous adhesions and removed. It showed evidences of a severe acute cholecystitis. The patient's further recovery was uneventful, and she left the hospital about three weeks later.

Since her discharge she had been fairly well, but was still slightly jaundiced. The blood picture was unchanged, she had hæmolytic jaundice, but she was up and about and was able to make her living, and her condition suggested the pithy saying of Chauffard regarding these patients that "they are jaundiced rather than sick."

Dr. Martin said he had presented this patient in view of the number of cases now being reported of a cure of this condition by splenectomy. In this instance he thought it was more important to remove the gall-stones than the spleen, for, as Tileston and Griffin, writing in 1910, said, "Attacks of abdominal pain resembling biliary colic have been observed in a large proportion of cases, and have been supposed to be caused in some mysterious way by the disease itself." In two of their cases, stones were removed at operation, and in both cases where an autopsy was secured stones were found in the gall-bladder.

Dr. Lyle said he saw a similar case in consultation last spring. In that case there was a family history of jaundice, three members of the family, aged respectively, seventy-two, sixty-one and fifty years, having suffered from this hæmolytic type of the disease. In his case, Dr. Lyle said, he refused to operate.

CARCINOMA OF THE GALL-BLADDER INVOLVING THE DUCTUS CHOLEDOCHUS

Dr. Walton Martin presented a man, fifty-three years old, who was admitted to St. Luke's Hospital on November 8, 1913, suffering from persistent jaundice, with loss of flesh and strength, and pain in the right hypochondrium. On examination, a small rounded mass could be felt on the right side near the ninth and tenth ribs. This moved with respiration. The margin of the liver could also be palpated. A diagnosis of carcinoma obstructing the common duct was made, and a cholecystenterostomy advised.

Upon opening the abdomen, the gall-bladder was found distended with a brownish, mucopurulent material. In the region of the ampulla there was a hard mass, evidently a carcinoma, involving this portion of the gall-bladder and the adjacent portion of the common duct. There were two large, hard lymph-glands close to the duct, and the head of the pancreas felt enlarged and hard. On account of the obstruction in the cystic duct it seemed that the removal of the gall-bladder and the establishment of a permanent biliary fistula was the

only procedure which would offer even temporary relief to the patient. The gall-bladder, a small segment of the adherent common duct and the neighboring lymph-glands were thereupon removed.

The patient made an uneventful convalescence. The bile escaped by the fistula established at the operation, about thirty ounces in the course of twenty-four hours. The patient gained in weight and was free from pain, and when he left the hospital, at the end of three weeks, a receptacle was arranged to receive the discharging bile. About three weeks ago this sinus closed spontaneously, the bile again passing into the intestine, a passage having apparently been established. The improvement in this case was of course only temporary, but the patient was at present in good health, without any fistula and free from jaundice. Pathologically, the mass removed showed carcinoma of the gall-bladder and the lymphatic glands. The re-establishment of a passage for the bile after a portion of the duct had been removed seemed very interesting.

CHOLELITHIASIS WITH PERFORATED DUODENUM HÆMATEMESIS

DR MARTIN presented a woman, sixty years old, who was admitted to the hospital on March 21, 1913, with the history that a week before that date she had begun to vomit blood, at first only in small quantities but gradually becoming more profuse until the day of her admission, when she vomited large quantities of clotted blood and also passed blood at stool. She said that about a year ago she had a sharp attack of pain which had been pronounced gall-stone colic. Excepting for this attack she had always been in good health.

Upon admission, she looked pale and very weak. Her pulse was rapid and feeble, the hæmoglobin was 40 per cent. On deep palpation, there was tenderness to the right of the epigastrium. On the two following days she vomited blood and passed some by the bowel, but in small amounts. Her general condition improved and an operation was advised.

Upon opening the abdomen in the midline, the omentum was found adherent to the liver and gall-bladder. The latter was small, and entirely filled by a stone the size of an egg. The lowermost portion of the gall-bladder was adherent to the duodenum, and on separating these adhesions, two openings with everted mucosa could be seen in the duodenum. The stone was removed, the perforations in the duodenum closed, and a posterior gastro-enterostomy performed. The patient made a satisfactory recovery and left the hospital three weeks later.

IMPACTED STONE IN THE COMMON DUCT

IMPACTED STONE IN THE COMMON DUCT

DR MARTIN presented a woman, thirty-seven years old, who was admitted to the hospital on September 5, 1913, deeply jaundiced and looking ill. Five weeks before that she had had a severe attack of epigastric pain, with vomiting, and three days later jaundice had developed. The jaundice had varied a little from time to time, but she had never been free from it. There was tenderness in the right hypochondrium, and rigidity in the right upper rectus muscle.

When the patient was operated on, three days later, the gall-bladder was found to contain many faceted stones. The common duct was dilated, and a mass of crumbling, soft material was found wedged in the lowermost part and extending to the papilla. The gall-bladder was incised and the stones removed. The common duct was then opened down to the duodenum and the friable mass removed with a scoop. This variety of impacted stone seemed to Dr. Martin to be of unusual interest, as it was soft and friable, and it was difficult to assure one's self that none had been left. As in this instance the patient made a good recovery and was free from pain and jaundice, he assumed that the common duct had been entirely freed from this material.

TRANSACTIONS
OF THE
PHILADELPHIA ACADEMY OF SURGERY

*Meeting held on February 2, in conjunction with the
Gento-Urinary Society*

DR JOHN H GIBBON, President, in the Chair

OBSERVATIONS ON THE DIAGNOSIS AND TREATMENT OF
SEMINAL VESICULITIS

DR B A THOMAS and DR HENRY K PANCOAST (by invitation)
presented a paper with the above title, for which see page 313

THE HIGH FREQUENCY TREATMENT OF BLADDER PAPILLOMA

DR A A UHLE presented a paper with the above title, for which
see page 319

DR B A THOMAS said that his experience had covered between twelve and fifteen cases and about 35 or 40 tumors, the reason for this excess of tumors over cases is because in one case in which the bladder was markedly trabeculated, there were no less than twenty tumors, from the size of a millet seed to that of a grape, scattered universally throughout the bladder. Even in that case it was possible to remove all of the tumors by this method. Perhaps a word should be said concerning the static machine *vs* the coil in the generation of the high frequency current. In the first case treated by him the static machine was used, Dr Wm L Clark supplying the electricity. That was in September, 1910, and was the first case in Philadelphia subjected to this form of treatment. The result in this case, together with the reports of a number of subsequent cases, was published in *Surgery, Gynecology and Obstetrics*, April, 1912.

Recently, in every case he had used the coil to generate the current, and so far as he could see, the effect is just as good as with the static machine, yet Dr Clark claims the desiccating current can only be obtained with the static machine. With regard to recurrences, they have not been as frequent as by incisional treatment, but in one case there

have been two recurrences. By the high frequency current, when recurrences do occur, and he believed they were not prone to do so readily, the condition is amenable to a repetition of the same treatment, while there is a limit to the number of cutting operations which a patient can stand.

DR HILARY M. CHRISTIAN called attention to the point brought out by Dr Uhle regarding the importance of looking after cases of hæmaturia, and regarding it not as a disease but as a symptom of some underlying condition, almost always some condition in the bladder itself. It is most difficult to determine malignant from benign papillomata of the bladder. In his opinion two or three of these cases recorded by Dr Uhle as malignant tumors had better have been left alone had they not been treated by the high frequency current. He would have liked to have heard more about the subsequent condition of these patients. Are they symptomatically cured, or are they really cured? His own operative work on papilloma of the bladder had been unsatisfactory, and if this method opens up any real field for radical work it is certainly promising.

DR THOMAS C. STELLWAGEN, JR., said that in the clinic of the Jefferson Hospital Professor Hiram R. Loux and he had had several cases of papilloma of the bladder. The high frequency current used to treat these cases was generated by the coil type of apparatus. They had seen Dr Clark demonstrate his static machine and they believe there is a difference in the mode of action of the current from the static machine and that from the coil machine. The current generated by the static machine will desiccate soap through a layer of delicate tissue paper without apparent injury to the paper. The current from the coil will not do this.

A completely practical electrode is necessary for intravesical work. This they have not as yet found. They have used the one made by Wappler, to which Dr Uhle refers. Two of them have lasted but a short time. The mechanical principle of this instrument is practical, but the insulation has been unsatisfactory. The amount of current necessary to destroy an intravesical growth is apparently sufficient to puncture the insulation.

The treatment of papillomata of the bladder by fulguration is, in many cases, a radical and curative procedure. In the afore-mentioned series of cases there are four in which the growth has not returned after two years. Fulguration is particularly applicable to growths adjacent to or involving the trigone. In this situation a resection in-

volves very radical surgical procedures, such as transplantation of ureters, which are associated with a high mortality rate. Papilloma of the fundus, or dilating portion of the bladder, involving the deeper layers of the viscus and undergoing ulceration and necrosis, should, in our opinion, be removed by partial cystectomy. The involved wall and a portion of the apparently healthy surrounding tissue should always be resected with the growth. In such cases it does not seem possible to desiccate or fulgurate the affected area without danger of perforating the bladder and inducing peritonitis. To temporize with such a condition aggravates it and stimulates growth. These factors increase the danger of carcinomatosis. In Prof. Loux's Clinic such a case died of metastasis to the liver and kidneys. In this clinic he had recently assisted in the resection of two papillomas, both of which involved the deeper layers of the bladder. In neither of these does he believe that fulguration would have sufficed. In one of these cases, after six months, there was a small recurrence in the line of incision, this has been treated by the Oudin current with some success.

It is the practice of Prof. Loux to have every case of partial vesical resection carefully watched for any return of the growth. Upon the slightest intimation of any recurrence the area is fulgurated. This method they believe to be the most radical and the one that offers most for the subsequent cure of the case. It does not seem good surgery to allow a carcinomatous area to remain and expect no recurrence. Why could not the general surgeon expect a similar result in other regions such as the alimentary canal? He does not, and the man who cures cancer of the stomach is the radical surgeon, so the man who cures cancer involving the deeper structures of the bladder is the radical surgeon.

DR E. H. SITER said that he had had quite a little experience with fulguration and high frequency currents in papilloma of the bladder and in answer to Dr. Christian's question, he did not think it would cure carcinoma of the bladder, but it reduces the hemorrhage and lengthens life. As to papilloma, it removes it. Perhaps Dr. Stellwagen has been in too much of a hurry, expecting to remove the papillomata in one application. One must have patience with the fulguration and the high frequency current must be applied a number of times. As a palliative measure, it has great advantages over cystectomy, in that the patient has not been subjected to the shock of an operation and the result is the same—that is, removal of the papilloma. Much cannot be expected of this treatment unless it is persisted in faithfully and patiently.

TREATMENT OF BLADDER PAPILLOMA

DR JOHN L LAIRD called attention to the fact that the apparently spontaneous disappearance of small papillomata on the treatment of adjacent growths is of frequent occurrence, and renders the direct treatment of such growths practically unnecessary. Whether this effect is due to transmission of the spark or its action through the intravesical medium or to trophic changes in the bladder wall, affecting the blood supply of the smaller growths, is not quite clear. He now had under treatment a case exemplifying this action. The patient was operated upon three years ago for a single large papilloma. There was a recurrence in the form of from thirty to forty smaller papillomata scattered over the entire bladder wall. At the first application of the high frequency current, all the larger growths on the left wall were treated. On examination two weeks later the larger growths had either disappeared or become much smaller and the smaller untreated tumors had entirely disappeared. Another illustrative case was that of a man with a diffuse papillary, villous growth extending over the anterior half of the trigone and into the deep urethra beyond the verumontanum. One treatment of a number of applications, certainly insufficient to reach directly all the tumors, produced a complete cure.

DR A A UHLE (in closing) agreed with Dr Thomas that the results obtained with the coil apparatus are as satisfactory as with the static apparatus. There seems to be a difference in the immediate effects produced, with the static machine there is less sloughing and the detritus is more granular. Relative to the diagnosis one cannot state definitely whether the growth is malignant or benign. The appearance of the growth, the character of its base, and the condition of the surrounding mucous membrane are factors which must be taken into consideration. A portion of the growth can very readily be removed for microscopic examination. It should also be remembered that benign tumors frequently become malignant if not removed, and that malignant recurrences frequently follow the removal of a benign growth. Early treatment is therefore essential.

In reply to Dr Christian relative to the condition of these patients after treatment he could state that the benign tumors were all cured with the exception of one who is still under treatment. The cystitis was aggravated in a few cases, particularly in one who had received 21 previous treatments elsewhere. Atony of the bladder was responsible for this condition. The cystitis was relieved in a short time by appropriate treatment.

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THE RELATION OF URETHRAL POLYP TO CHRONIC URETHRAL SYMPTOMS

DR ALEXANDER RANDALL (by invitation) presented a paper with the above title, for which see page 325

DR HILARY M CHRISTIAN recalled three cases of chronic anterior urethritis treated by himself by the ordinary high dilatation method, where the underlying factor in each case was a urethral polyp found by the urethroscope after five or six weeks of treatment with dilatation. He was very much interested to hear Dr Randall's points brought out associating the tumors in the posterior urethra with sexual neuroses. This is a very important matter and it is one that neurologists are inclined to overlook and to put the patients down as maniacs or neuropaths, while the probabilities are that underlying a large part of these men's troubles there is some condition of the posterior urethra which the urethroscope will divulge.

DR B A THOMAS related the history of a patient who had never had a neisserian infection. He was markedly neurasthenic. He was in the habit of urinating every few minutes, twenty to thirty times a day. Endoscopy revealed a definite tumor which even with the urethroscope could be diagnosed as a solid tumor, a fibroma, situated on the posterior part of the verumontanum. After cocaineizing it with 10 per cent cocaine introduced through the sheath of Young's prostatic punch, he then readily and painlessly removed the growth by means of this instrument. The symptoms at the present time are *nil*.

HOW SHALL THE CLINICIAN INTERPRET THE WASSERMANN REACTION?

DR W M MACKINNEY (by invitation) read a paper with the above title, for which see page 309

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PRINCIPLES OF OPERATIVE TREATMENT OF THE DISEASES OF THE LARGE INTESTINE*

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THE operative treatment of the diseases of the large intestine is still far from being perfect. The number of unsolved problems here is a considerable one, and is due to two reasons. First, though the application of the operative treatment of these cases is becoming wider with every day, the indications for the adoption of one or another method of treatment is not sufficiently settled yet. To prove this I may mention the treatment of *megacolon congenitum*, *colitis*, and that of *volvulus*. Second, the methods of anastomosis and of resection of the large intestine themselves have still to be more carefully investigated and improved.

RESECTIONS

Nature of disease	Parts affected	Extent of resection	Cases	Deaths
Carcinoma	Stomach and transverse colon	Stomach and transverse colon	3	3
Carcinoma	Cæcum	Cæcum and ascending colon	2	1
Carcinoma	Colon descendens			
	(a) without obstruction	Part of colon descendens	1	0
	(b) with obstruction	Part of colon descendens	1	1
	(c) with obstruction and peritonitis	Part of colon descendens	1	1
Carcinoma	Transverse colon and fecal fistula	Transverse colon	1	1
Sarcoma	Sigmoid	Sigmoid	1	0
	Cæcum	Cæcum	1	1
Tuberculosis	Cæcum	Cæcum and colon ascendens	3	0
	Hepatic flexure	Cæcum and colon ascendens	1	0
	Sigmoid, colon descendens and transverse	Sigmoid, colon descendens and transverse	1	0
Inflammatory tumor	Cæcum	Cæcum	1	0
Fecal fistula	Ileum	Ileum, cæcum and ascending colon	1	0
Colitis		Transverse colon	1	0
Colitis		Descending colon	1	0
Intussusception	Cæco-iliac	Ileum, cæcum and colon ascendens	1	0
			21	8

* Translated from the Russian by G. de Swietochowski, M.D., M.R.C.S., of London

It is a fact that the literature which deals with these problems is very extensive, to give a full account of it would, therefore, unduly complicate my present task. I think it will be more to the purpose if I confine myself to my own observations chiefly, quoting only such facts from literature which seem to me both interesting and important. Without making a review of such minor operations as colopexies, colotomies and closing of fistulæ, I shall here mainly discuss such bigger operative measures as resections and exclusions.

It appears from the foregoing figures that resections of the stomach, when combined with those of the colon, end fatally. According to my observations and to those of other authors, it is usually some such place as a loop of the duodenum, or a loop of the large intestine, that is the origin of infection, thus being the cause of death, which often follows such extensive operations.

My own experience and that of others makes me rather inclined to count among inoperable cases such patients, who, owing to the spread of the cancer, would require a resection of the transverse colon as well as that of the stomach. The reports of Perthes, however, restrain me from passing such judgment. Perthes lost only one out of four similar cases, the other three have enjoyed good health for a considerable period after the operation.

The above figures show also that both of the two patients, who underwent resection of the bowel on account of symptoms of obstruction, died, the situation in one of them being, moreover, complicated by perforative peritonitis. Barring these five cases just mentioned, 16 cases of resection of the large bowel remain out of the total of 21, with but three deaths.

EXCLUSIONS

Nature of disease	Extent of resection	Cases	Deaths
Carcinoma of the stomach and transverse colon and fecal fistula	Gastro-enterostomy posterior, ileosigmoidostomy	1	1
Carcinoma of descending colon and carcinomatous peritonitis	Ileosigmoidostomy	1	1
Fecal fistula tuberculous cæcum	Ileotransversostomy	1	1
Fecal fistula ileum (cæcum?)	Ileosigmoidostomy	1	1
Fistula sterni vag. ileum	Ileotransversostomy and division of ascending colon	1	1
Tuberculosis of cæcum	Ileotransversostomy	1	0
Kinked hepatic flexure	Ileotransversostomy	1	0
Ulcerative colitis	Ileotransversostomy	1	0
Chronic mucomembranous colitis	Ileosigmoidostomy	1	1
Fecal fistula of transverse colon	Ileosigmoidostomy	3	0
Non malignant obstruction of splenic flexure	Ileosigmoidostomy	1	0
	Division of transverse colon	1	0
	Transversosigmoidostomy	6	0
		20	6

We pass now to the intestinal exclusions

Thus, having excluded minor operations such as colotomies, artificial anus, fistulæ and colopexies, I have at my disposal a material of 41 cases, in which I performed more serious operations on the large intestine. There is not much object in adding up here the percentage of deaths, because, owing to the great variety of cases, an average figure of mortality would not tell us anything. The figures quoted above relate to operations which the author had personally performed up to June 11, 1913.

However diverse may be the diseases of the large intestine which necessitate one or another surgical intervention, the operations themselves present here a certain similarity. This, however, does not mean yet that all the operative measures were to be called identical. By no means! But, on the other hand, there is no doubt whatever that the same therapeutic measures are often applied in different complaints. This can easily be proved by considering for a moment the treatment of such different cases as congenital megacolon, ulcerative colitis, carcinoma and volvulus of the large intestine.

In cases of congenital megacolon the treatment consists of coloplication, colofixation, artificial anus, entero-anastomosis and resection of the sigmoid.

For ulcerative colitis we perform colostomy, ileosigmoidostomy, and resection of the bowel. In carcinoma we have again resection, entero-anastomosis, fixation, artificial anus, and invagination, which has lately been recommended by I. I. Grekoff, and which, though for some other reason, was introduced 12 years ago by Prof. S. P. Fedoroff. Leaving out colopexy, whatever case we may have to deal with, we appear to revolve mainly round the three operative possibilities: resection, entero-anastomosis, and colotomy. These three operations will now be considered a little more closely.

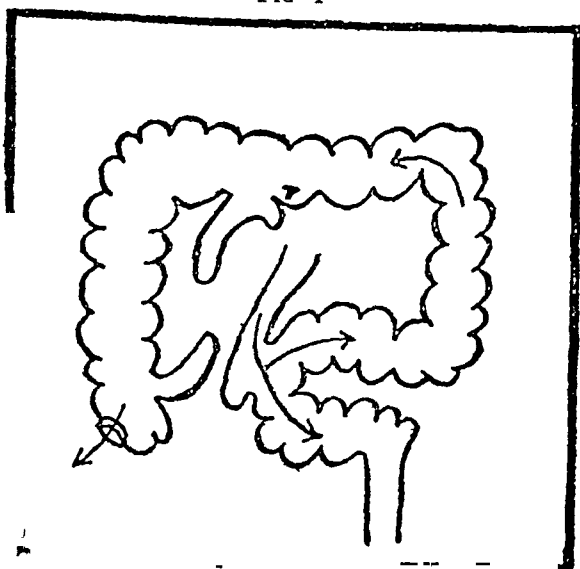
Up to quite recently we used to make a strict difference between a partial unilateral, a complete unilateral, and a complete bilateral exclusion of the large intestine. To simplify my task I shall leave aside the first mentioned method, and shall only consider here the second one, the so-called unilateral exclusion of the large intestine, effected by means of ileocolostomy and division of the distal portion of the ileum.

In my work on the principles of operative treatment of fecal fistulæ, I quoted a case of a tuberculous fistula of the cæcum on which I had to operate twice. First, I performed ileocolostomy (transverse colon) with division of the ileum, and afterwards an ileosigmoidostomy, also with

division of the ileum. The final result is depicted in Fig 1. The operation did not cure the fistula, because the fæces began to pass in a reverse direction through the large intestine, and came out through the fistula. Soon afterward I operated on another patient who suffered from an otherwise incurable chronic colitis, in this case the pains which had temporarily abated after ileosigmoidostomy had been performed returned later on. And when finally colotomy was performed, the motions passed through the opening.

Based on these facts, and aided by the case of Prof S P Fedoroff, I came to the conclusion that in order to cure a fecal fistula of the large intestine by means of an anastomosis, it is necessary to have recourse to a complete bilateral exclusion, and that extensive unilateral

FIG 1



exclusions are insufficient, because the contents of the bowels return through the large intestine to the fistula.

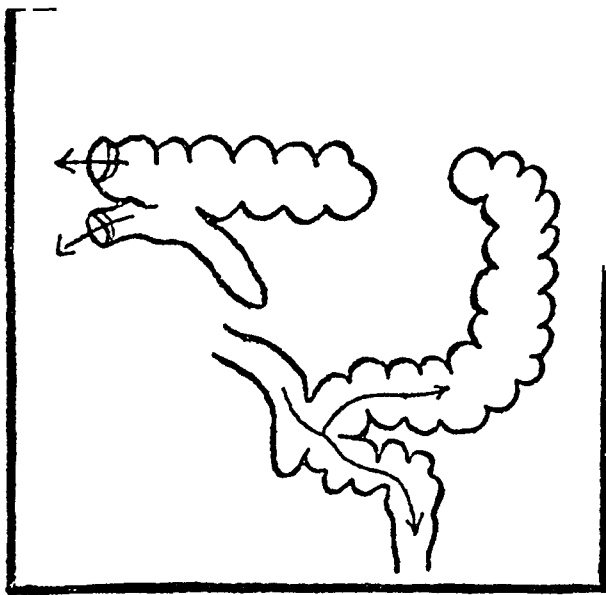
However, the statements of other authors on this subject made me doubtful of the correctness of my conclusion, and especially the investigations of Roith seemed to me very convincing. According to his views the transverse colon in its left two-thirds, as well as the descending colon, is not capable of performing any antiperistaltic movements, at least not as a rule, thus no fæces can pass along those sections of the bowels in a reverse direction.

Owing to the importance of this investigation, I felt justified in counting my cases among the "exceptions," and in trying ileosigmoidostomy once more. Following my own method (consisting of three stages) I resected in one of my cases the cæcum and ascending

colon, which were both affected by carcinoma, in consequence of this the patient developed fistulæ of the transverse colon and of the ileum, which would not heal, in spite of my having attempted three times to close them by means of a suture

I then had recourse to ileosigmoidostomy with division of the proximal portion of the ileum, two or three days after the operation, fæces appeared again through the fistula of the transverse colon. Thus we have the old complication of the retrograde movement of the contents along the large bowel repeated all over again. I now divided the transverse colon at the splenic flexure, thus converting the fæcal fistula into a mucous one. The result of this operation is demonstrated in Fig. 2. A year and a half later I saw the patient again, his mucous

FIG 2



fistula did not inconvenience him much, he looked exceedingly well, and was free from all complaints

This case proves that in patients suffering from a fistula of the colon even an ileosigmoidostomy is accompanied by a reversed peristalsis of that part of the large intestine. Hence it follows that in these cases the so-called complete unilateral exclusion is inapplicable for the simple reason that it does not really exclude anything. The latest investigations of Kopiloff have confirmed the above statement

One might imagine that the presence of a fistula in the large intestine predisposes to a reversed current of the intestinal contents, and that the fæces are propelled even by a normal peristaltic wave toward the point of least resistance, that is, toward the fistula. One might

also think that if there were no fistula there would be no such movement, and that *per se* the so-called unilateral exclusion is applicable to cases in which there is no fistula, and where there is also no organic hindrance to a free passage of the intestinal contents, as, for example, is the case in colitis. However, the facts relating to the above mentioned disappoint us more with every day.

After a complete unilateral exclusion, no matter whether such exclusion was effected by means of a communication between the ileum and the transverse colon, or by means of ileosigmoidostomy, the part of the colon thus excluded forms a cul-de-sac which accordingly varies in length. It also appears that this sac can by means of a retrograde peristaltic movement fill up with fæces and thus cause serious trouble. Grekoff has mentioned a case in which an accumulation of fæces in the cæcum after an exclusion led to a perforation, and caused the death of the patient. De Quervain informs us that, in consequence of an accumulation of fæces, he had twice to resect the cæcum and the ascending colon, following an anastomosis between the ileum and transverse colon. Franke, formerly an ardent advocate of ileosigmoidostomy, has lately begun to talk about the dangers of antiperistaltic movements of the large intestine.

Quite recently, von Beck stated that out of his 32 cases which underwent ileosigmoidostomy owing to chronic colitis, pericolitis, and also owing to an unsatisfactory position of the large intestine, six cases, in the course of time, developed intestinal stasis in the excluded cul-de-sac.

Thus, one fact after another points out emphatically how very relative the value of the complete unilateral exclusion is, even in cases where there is no fecal fistula. The formation of cul-de-sacs out of portions of the large intestine apparently brings with it the well-defined danger of the overflow of its contents, and consequently of perforation.

We involuntarily turn our mind now to the formation of cul-de-sacs in connection with other operative measures, such as resections and complete exclusions. Their number is large enough to justify a more detailed consideration, and we have to make now an attempt to explain their origin and their significance.

Above I quoted a case where ileosigmoidostomy was performed in consequence of a fecal fistula of the transverse colon, and in which that part of the large intestine was divided just to the right of the splenic flexure (Fig. 2). It is obvious that this patient developed a cul-de-sac extending from the splenic flexure to the top of the sigmoid

a part of the stomach, a portion of the jejunum and a part of the transverse colon. However, I am not going to describe this operation in detail, as Fig 4 diagrammatically shows the result. Here again a cul-de-sac had formed out of the descending colon. In spite of the ideal healing of all internal sutures, which, in fact, were very numerous, the patient died of exhaustion, within a fortnight, an abscess having also formed in the vicinity of the descending colon.

Considering now more closely all that has been said before, we find that even comparatively short cul-de-sacs of the large intestine are very troublesome, since they favor fecal stasis and predispose to perforation, thus sometimes rendering either a resection or a fistula inevitable. All these blind sacs represent nothing else but unilaterally excluded and comparatively short portions of the colon.

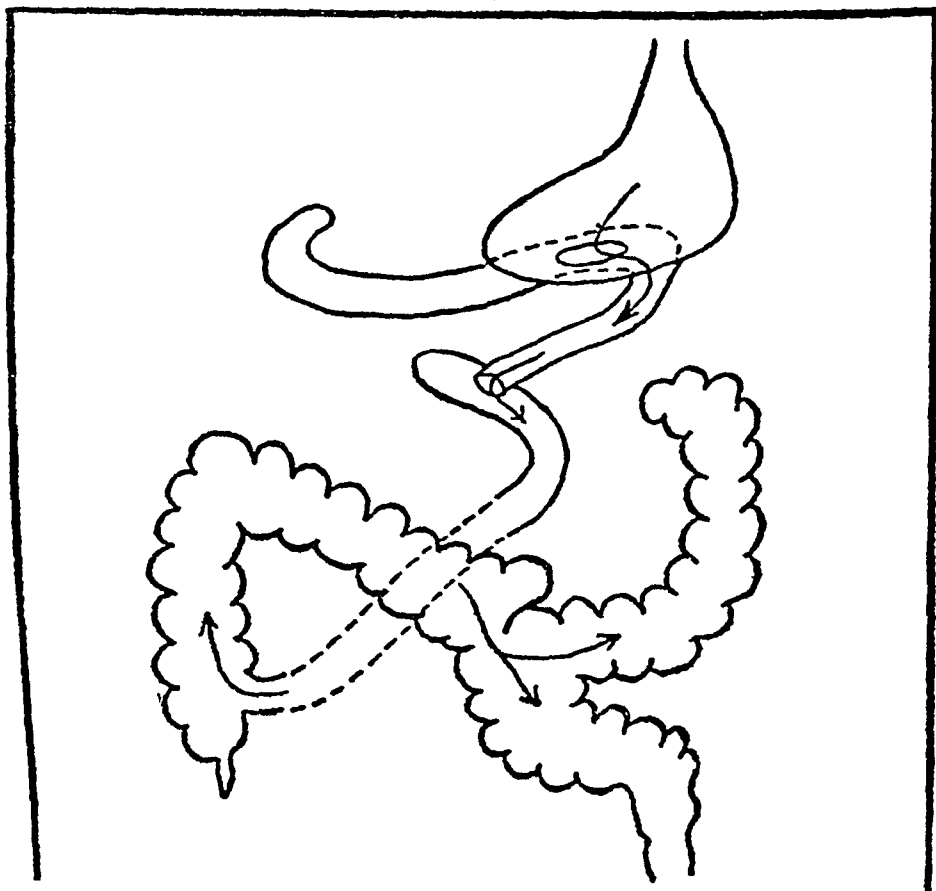
Clinical observations of what I might term the operative formation of cul-de-sacs of the large intestine are published as single cases, and the picture of the unfavorable effect of these structures is still but a very dim one at present. And it is still rather difficult to pronounce the effect of such cul-de-sacs as absolutely unavoidable. So much so, that in order to obtain a clear explanation of this question I was obliged to have recourse to an experiment. With clinical facts to start with, one can sketch out a whole series of imaginary cul-de-sacs, and one can study all their variations on animals. A series of such suggestions, as those on Fig 5, I proposed to Dr A. A. Perlman for experimental investigation.

Up till now we have discussed that group of cases in which there were no hindrances to a free passage of the intestinal contents throughout the distance between the site of the anastomosis, such as ileosigmoidostomy, and the top of the blind end of the gut be it in the cæcum, hepatic flexure, or splenic flexure. Consequently, it is necessary to consider now also that category of cases in which there is a narrowing of the large intestine of some kind or other.

It is sufficient to glance at Fig 6 in order to arrive at the conclusion *a priori* that ileocolostomy can be adopted only in cases of an affection of the cæcum, because a real narrowing of its lumen will interfere with the backward progress of the fæces. In all other cases, should no return of the fæces occur after ileosigmoidostomy, then the secretions of the intestine will accumulate in the proximal section of the gut, and the cul-de-sac will again be distended. As a matter of course, this problem also requires experimental investigation, and V. N. Nazarov, following my suggestion, set to work to tackle this question.

was no possibility of bringing the end of the remains of the colon transversum and the pelvic colon together, I had to close both ends of the bowel, and, having removed the appendix, I united the cæcum with the pelvic colon by means of a lateral implantation (Fig 3) Some time after, signs of stasis appeared in the cul-de-sac thus formed griping pains, distention and peristaltic movements of the blind portion of the bowel Having noticed this, I established a fistula of the ascending

FIG 4



colon, as it was obvious that the blind pouch was overfilled with fæces

Studying the literature on this subject, I came across a description of a case of Haberer, who, having performed resection for carcinoma of the stomach and transverse colon, thought lateral anastomosis necessary between the cæcum and the sigmoid This patient died of perforation of the ascending colon

As a parallel case to the one just described, I might quote a case of my own, in which, owing to a *carcinoma ventriculi*, I had to resect

a part of the stomach, a portion of the jejunum and a part of the transverse colon. However, I am not going to describe this operation in detail, as Fig 4 diagrammatically shows the result. Here again a cul-de-sac had formed out of the descending colon. In spite of the ideal healing of all internal sutures, which, in fact, were very numerous, the patient died of exhaustion, within a fortnight, an abscess having also formed in the vicinity of the descending colon.

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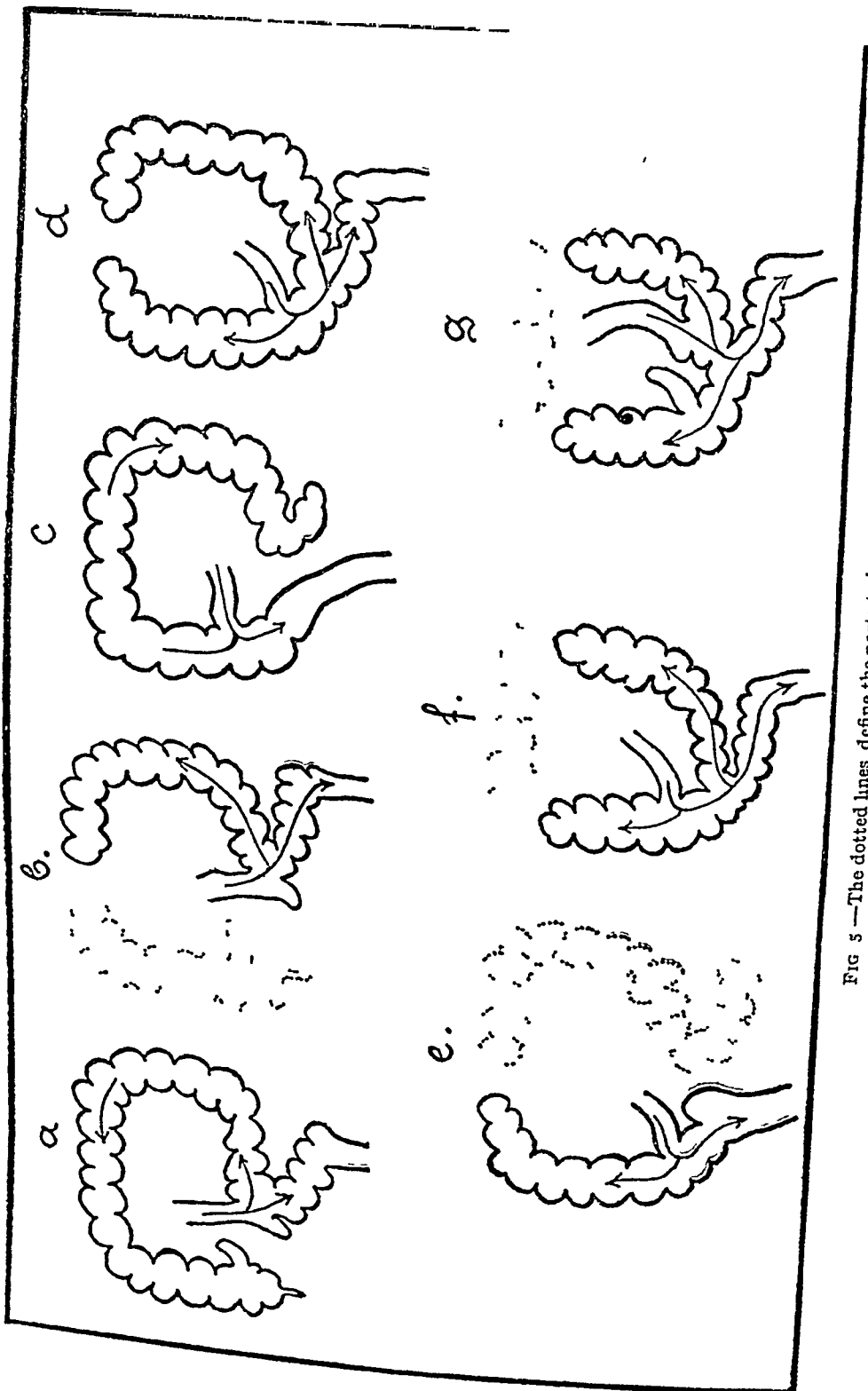


FIG 5 —The dotted lines define the parts to be resected

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I have considered the so-called complete unilateral exclusion more fully because of its great importance. Whatever we do, whether a complete bilateral exclusion or a resection of the large intestine, we should, as far as possible, avoid the formation of cul-de-sacs. Should they be inevitable, and should we on purpose desire to perform ileo-

FIG 6

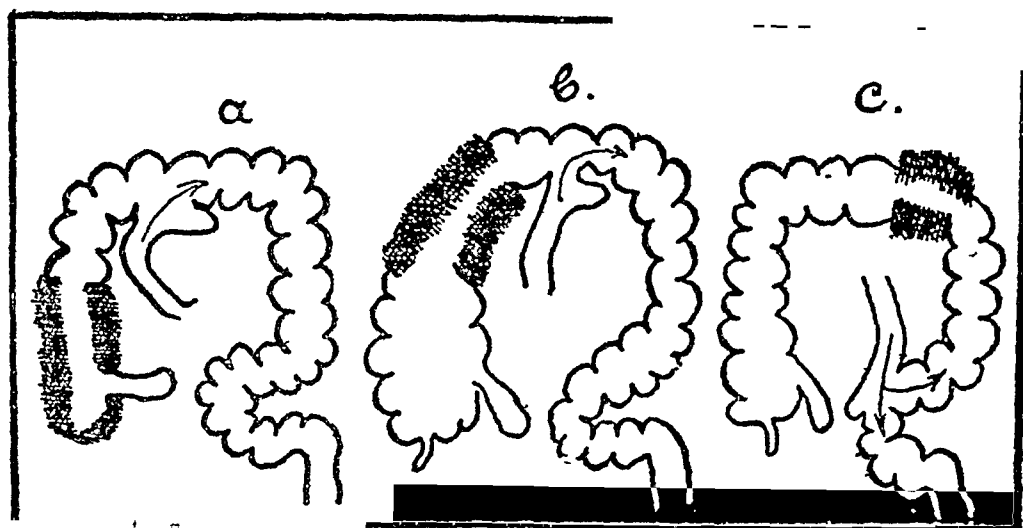
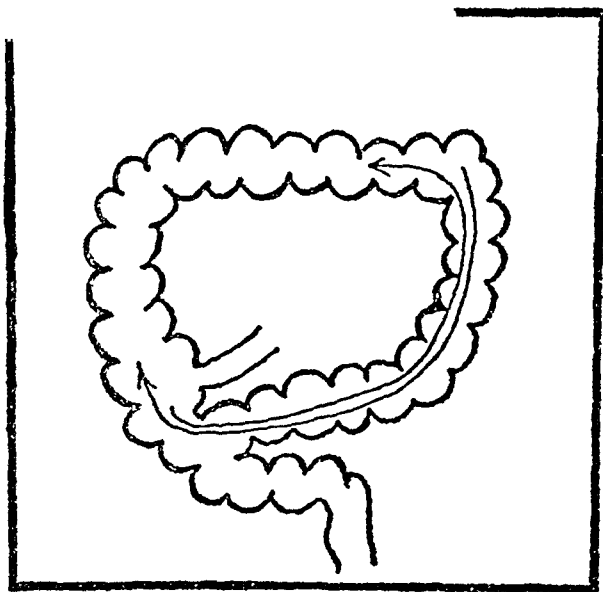


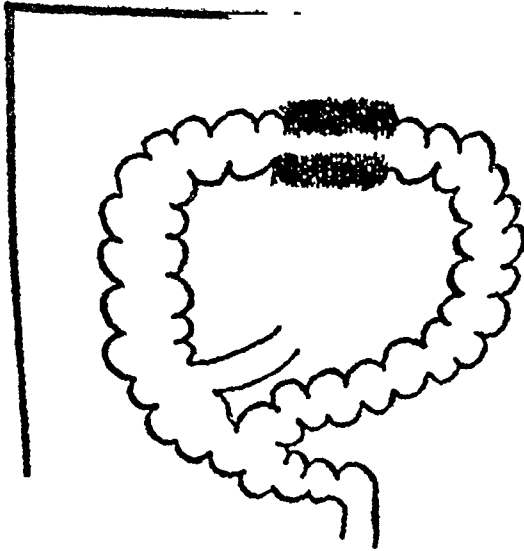
FIG 7



colostomy, then such exclusions ought to be combined with a fistula at the top of the cul-de-sac. I shall presently come back to the discussion of all these questions. Meantime, considering that ileocolostomy without complementary measures has an extremely narrow application, I should like to finish the subject of extensive unilateral ex-

clusions of the large intestine in which the exclusion is not accompanied by any formation of a cul-de-sac I am speaking here of Giordano-Bergmann's operation. This consists of establishing an anastomosis between the top of the cæcum and the sigmoid. As it is known, Bergmann recommended this operation as a treatment of volvulus of the sigmoid. At the first sight it may appear that such an exclusion enables the cæcum to empty its contents straight into the sigmoid, and thence into the rectum. However, a closer investigation of this matter shows that Giordano-Bergmann's operation creates nothing but an endless colon in which the fæces move in a circle. Indeed, cæcosigmoidostomy draws both guts together, it closes the ring of the colon, and, to a certain extent, owing to the fixed position of the sigmoid, it

FIG 8



interferes with the discharge of fæces *per vias naturales*. Looking now at the circle of the colon thus formed, we shall see that every peristaltic movement will drive the intestinal contents in either direction.

In practice I came in contact with Giordano-Bergmann's operation in a female patient suffering from *colitis dolorosa*. Koerte, thinking that the pains in the large intestine were caused by pericolitis of the hepatic flexure, performed cæcosigmoidostomy. I must add, that this case was an exceptionally severe one, I was not able to cure her in spite of a series of consecutive operations, Giordano-Bergmann's operation, however, had undoubtedly aggravated her condition.

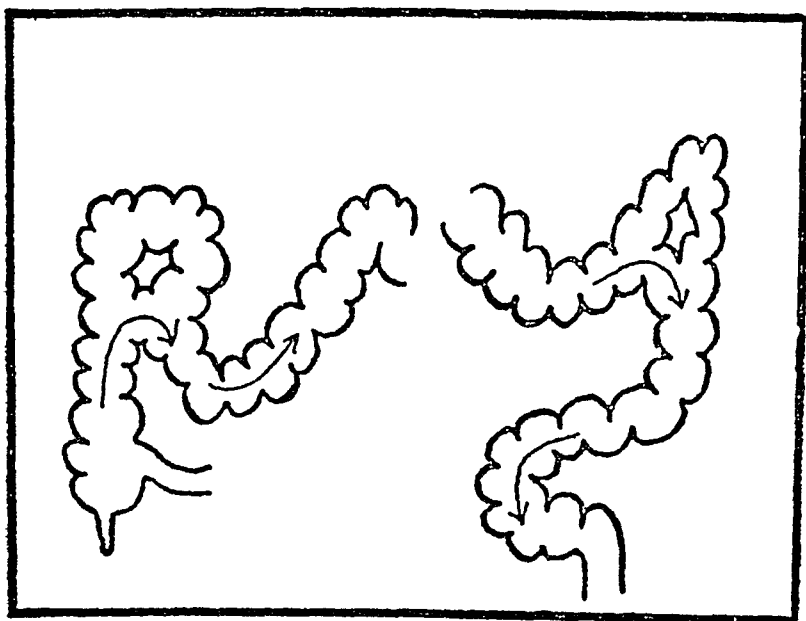
Let us assume for a moment that we had a case in which there really was an obstruction of the intestine, either at the hepatic flexure,

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or in the middle of the transverse colon Giordano-Bergmann's operation would in such a case produce two cul-de-sacs at a time (Fig 8) After all that has been said about single cul-de-sacs, the establishment of two cul-de-sacs will hardly appear desirable! Even the extent of the exclusion of the intestine does not influence Giordano-Bergmann's operation for the better, since, as we have seen, the larger the exclusion made, the worse the results, a vicious circle is established in the large intestine, and two cul-de-sacs on top of that

Together with a complete unilateral exclusion there existed for a long time the partial unilateral exclusion, better known under the name of entero-anastomosis. It is hardly necessary to say that this latter operative measure is not applicable in the treatment of certain

FIG 9



troubles, such as, for example, fecal fistula and colitis Its application is mainly limited to obstructions of the large intestine, mostly of a non-malignant character, here belong pericolic contraction, kinks of the large intestine, as well as benign strictures In fact, under such circumstances entero-anastomosis forms a short circuit round the hindrance, and the more economically it is being done in these cases, the more, apparently, satisfactory are its results

At any rate, this holds good with regard to cases where hepatic and splenic flexures of the colon are kinked or contracted Payr and others have successfully adopted colocolostomy between the transverse colon on the one hand, and the ascending and descending colon on the other, in cases of movable or dropped transverse colon I maintain

that this type of operation (Fig 9) is satisfactory, because it does not leave any cul-de-sacs behind it

To this kind of operative measures belong sigmoidorectostomy, performed in cases of megacolon of the sigmoid (5 recoveries out of 7

FIG 10

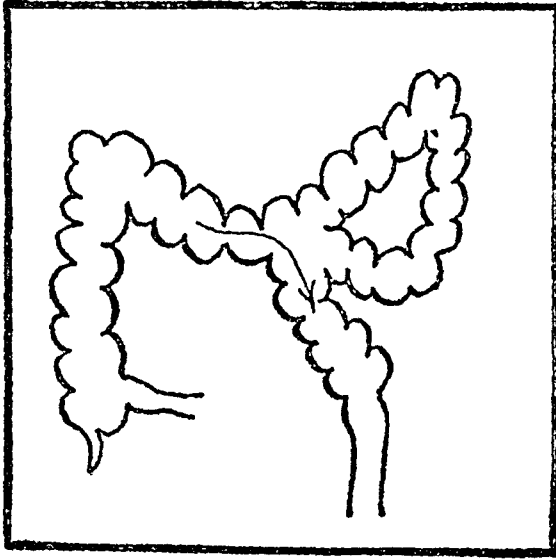
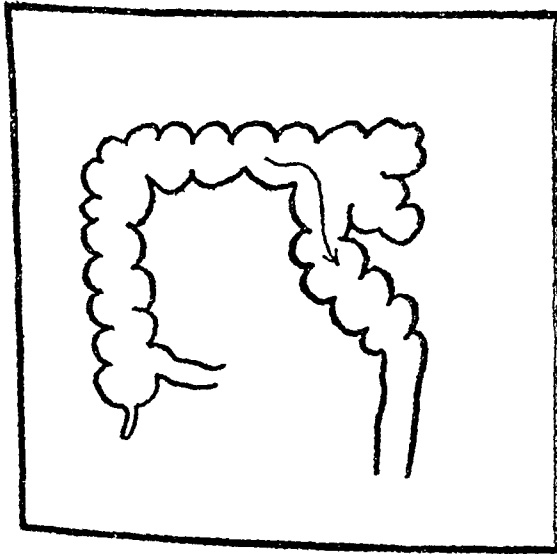


FIG 11



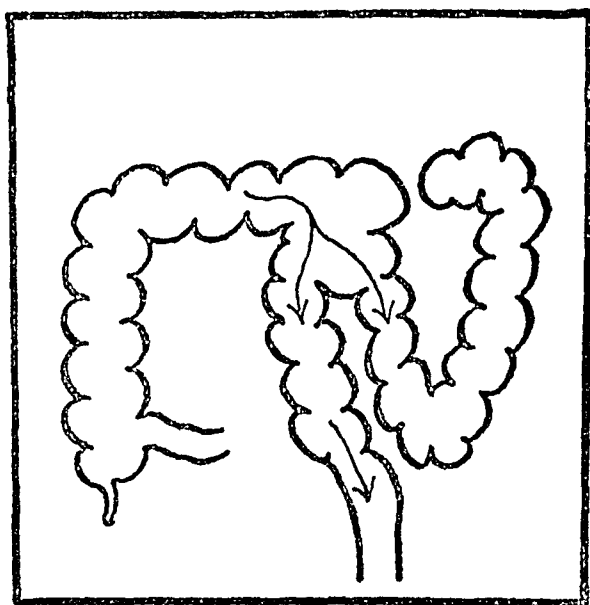
cases), and, finally, the Troyanoff-Winiwarter anastomosis between the loops of the sigmoid at the site of its flexure

An economical exclusion proves to be sometimes impossible in consequence of the anatomical position of the large intestine, and we are

bound to adopt more extensive exclusions in these cases. Transverso-sigmoidostomy (Fig 10) will play the chief rôle in the exclusions of the left half of the colon, ileotransversostomy applying to the right half.

I had to perform transversosigmoidostomy 6 times for different reasons. One (female) patient died, in whom the sigmoid flexure was rather short, though it was easily brought together with the transverse colon. Two days after the operation I had to perform another laparotomy, because of an obstruction of the small intestine, I found that the comparatively short mesosigmoid formed a fulcrum on which a loop of

FIG 12



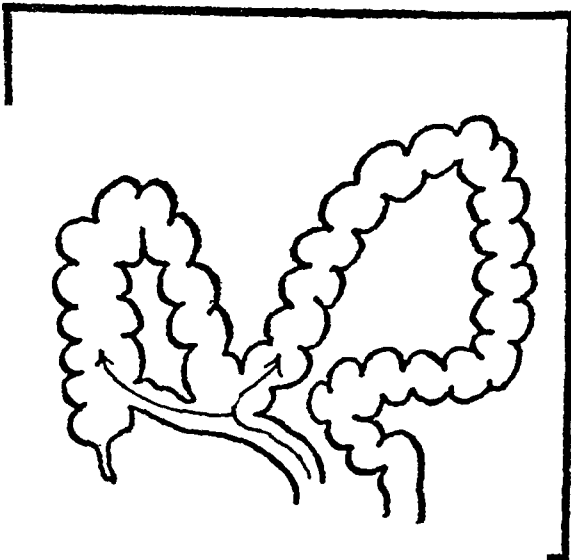
the small intestine became kinked. The operation, however, did not save her life.

The remaining 5 patients have borne the operation quite satisfactorily. One of them has felt perfectly well during the 5 years following the operation, having been under my observation all that time. In another patient, within a year's time, I resected the large intestine, beginning with the splenic flexure, and ending with the anastomosis of the sigmoid, in order to cure colitis. Afterwards Prof. N. N. Petroff, in Warsaw (within a few months), performed another operation on the same patient, because of a contraction of the communicating opening.

The three remaining patients felt considerable improvement after the operation. Two of them I lost sight of, the third one, suffering from tuberculosis of the descending colon, showed himself to me from time to time, but, having definite symptoms of a lung trouble, he most likely perished from tuberculosis.

As it may be seen, for example, from Fig 10, an excluded ring of the large intestine is formed in consequence of transversosigmoidostomy. Should we imagine that in the corner of the splenic flexure arises some hindrance for the free passage of the intestinal contents, then again we have to face the question of cul-de-sacs. I think, however, that one cannot identify the type of cul-de-sac following transversosigmoidostomy with the cul-de-sac resulting from ileocolostomy, which is carried out with a division of the distal portion of the ileum. They would become identical then, when to the transversosigmoidostomy were added the division of the transverse colon beyond the anastomosis (Fig 12). In the absence of such division, transversosigmoidostomy does not interfere with the passage of fæces through the site of obstruc-

FIG 13



tion, and it empties the proximal portion of the transverse colon. In this manner the continuity of the peristalsis must counteract the accumulation of fæces in the descending colon. At any rate the descending colon, which was resected by myself within a year after I had performed transversosigmoidostomy, was neither dilated nor overfilled.

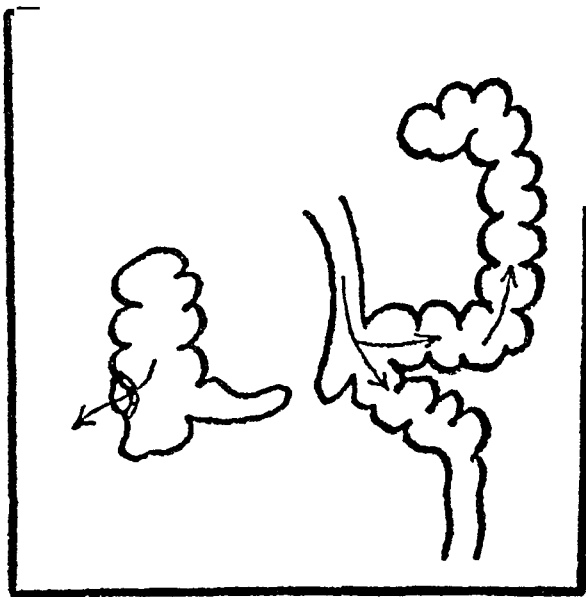
To confirm all that has been said above, I shall quote one more case. This was a patient in whom the right half of the transverse colon formed a loop hanging down as far as the pelvis. The patient suffered from obstruction and pain in the region of the ascending colon. As I intended to empty the cæcum and the ascending colon, I performed ileotransversostomy (Fig 13) without dividing the distal ileum. I saw the patient several times after, and even operated on him twice for some

other reasons; the obstruction and the pains, however, have not been complained of any more

Thus, the partial unilateral exclusion may well be considered a successful means of emptying the proximal portion of the gut in cases of obstruction. At any rate, where we can choose between a complete unilateral and a partial unilateral exclusion, preference should be given to the latter. An exception is made for the strictures of the cæcum, in which case ileotransversostomy with a division of the ileum must be preferred to an ileotransversostomy without a division of the distal ileum.

Entero-anastomosis undoubtedly cannot always replace complete exclusions. As, however, complete unilateral exclusion in reality does

FIG 14



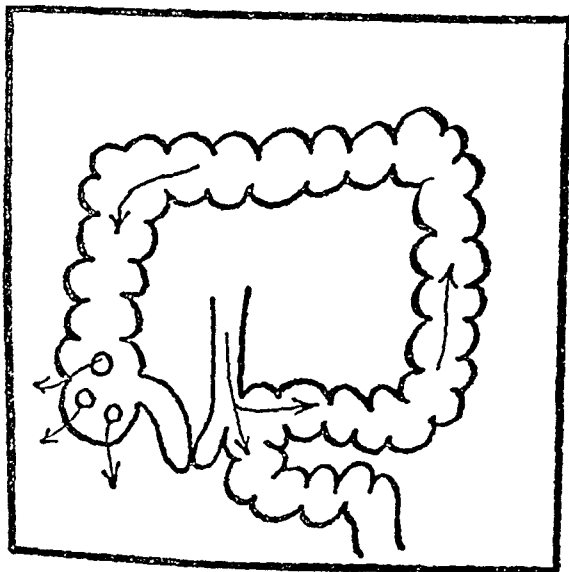
not exclude anything, there remains only the so-called complete bilateral exclusion. The application of the latter is considerably wide. On the one hand, this method may be adopted as a preliminary step towards the resection of the large intestine, and, on the other hand, as a final measure, where resection is either impossible or inadvisable. The simplest example of the application of the complete bilateral exclusion is seen in fistulæ of the large intestine. A fæcal fistula is converted into one which discharges mucus, the presence of the fistula securing a free discharge of the contents from the excluded bowel. The therapeutic value of such a fistula is beyond all doubt.

In the beginning I mentioned a case in which I performed a complete bilateral exclusion of the transverse colon. A year and a half later this patient did not any more want to run the risk of a resection.

of the excluded bowel, because his mucous fistula did not inconvenience him much

The following case is still more instructive I have already spoken of a patient suffering from *colitis dolorosa* The following was the result of this very difficult operation which consisted of resection of the transverse colon and of the upper portion of the ascending colon, and of an abolishing of an anastomosis between the cæcum and the sigmoid (Fig 14) On the right side the cæcum and the remains of the ascending colon were bilaterally excluded, being supplied with a fistula which had been there for some time After the operation the pains in the descending colon were so great that, as I have already said, I was obliged to establish a fecal fistula The portion of the

FIG 15



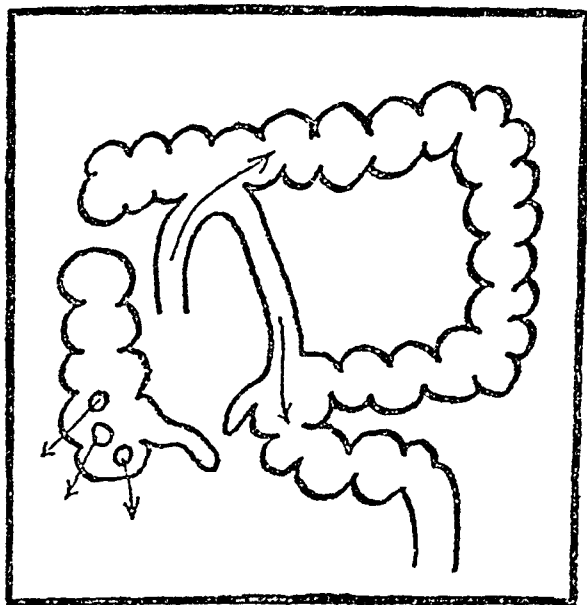
large intestine which was bilaterally excluded remained completely painless and sound

We see, therefore, that in performing bilateral exclusions of the large intestine in order to cure fistula, we have to consider first, how to do it as economically as possible, and second, how to avoid the formation of a cul-de-sac from the remains of the large intestine

I should like to give an example in order to explain the above assertion I mean a case which after a gangrenous appendicitis developed several fecal fistulæ in the right iliac fossa Those surgeons who operated on this patient on account of his fistulæ apparently had no doubt whatever (myself included) that these were fecal fistulæ of the cæcum The last operation performed previous to mine, consisted of ileosigmoidostomy, and of a ligature applied to the distal

position of the ileum (Fig 15). The escape of fæces through the fistula, however, had not ceased. This might have been explained, either by being due to the ligature having become patent to the intestinal contents, or to a retrograde movement of the fæces, or, more correctly, due to both. In order to do away with this symptom I decided to undertake bilateral complete exclusion of the cæcum and ascending colon, to resect the site of the ligature, and I contemplated the division of the ascending colon at the hepatic flexure. This, however, would leave a long cul-de-sac behind. To avoid the formation of the latter I began the operation by performing ileotransversostomy, the result of which is seen on Fig 16. It follows, that after the opera-

FIG 16



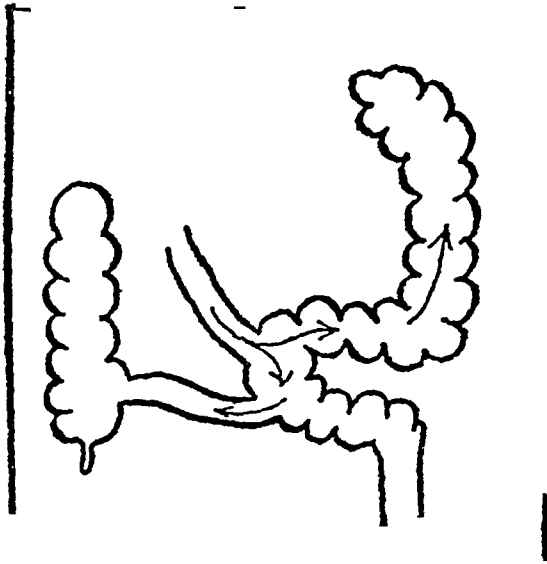
tion the small intestine discharged itself into the large intestine at two places, and above all, the cul-de-sac was abolished. In spite of all that, the operation did not prove successful: the fistulæ continued to discharge fecal matter, the presence of a communication between the rectum, and, apparently, the cæcum was revealed, and I had thus to decide upon resection of the excluded portion of the gut. I shall come back to this subject lower down.

A case of Wiesinger proved conclusively that the complete bilateral exclusion, combined with a ligature of both ends of this excluded gut, and leaving it in the abdominal cavity, is an operation which is not practicable. In Wiesinger's case the excluded large intestine, over-filled with mucus, perforated, causing death 13 years after the operation. Hence every bilateral exclusion, whatever may be its object, must

necessarily be accompanied by the establishment of a fistula of the excluded portion of the gut. It is easy to imagine a case of complete exclusion done in dealing with a carcinoma, tubercle or colitis, and it is easy to imagine the process of establishing a fistula. It is, however, somewhat difficult to see one's way clearly with regard to those cases, where the complete bilateral exclusion appears to be a part of the result of the resection of the large intestine.

Previously, the formation of cul-de-sacs was discussed as a sequel to resections of the large intestine. Now it appears that the resection of the colon gives rise to a formation of cul-de-sacs blind at *both* ends. As an illustration may serve here Montprofit's operation, which divides the ileum and implants both proximal and distal ends of this gut into

FIG 17



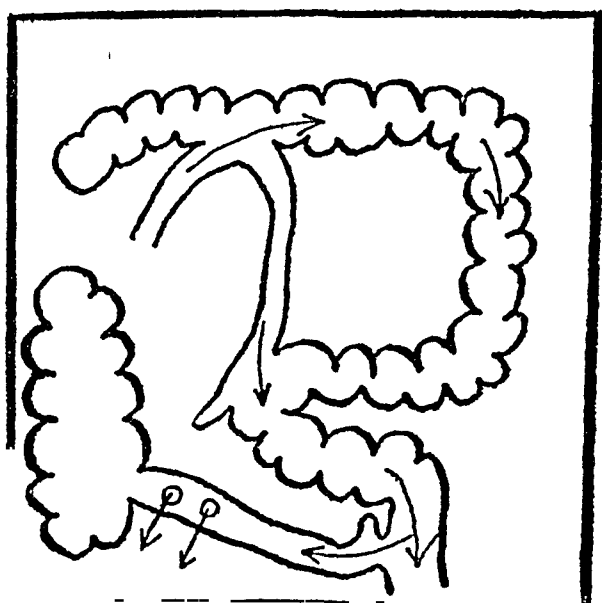
the sigmoid (Fig 17). The afferent portion of the ileum has to empty the small intestine, and the efferent, the cæcum.

Dr Katchanoff studied Montprofit's operation, and, in my opinion, correctly arrived at the conclusion, that the ileocecal valve prevents the cæcum from being emptied. Katchanoff's conclusion was based on his observation of a case of a (female) patient on whom Prof Fedoroff carried out Montprofit's operation, and on whom later on I had to perform another laparotomy on account of peritonitis. The latter originated in a loop of the ascending colon, the cæcum and the ascending colon being extremely distended by gas.

At the present moment I should like to complete the discussion of Montprofit's operation, and I shall therefore turn now to the description

of the case I have just been talking about, the patient with the fecal fistulæ. The resection which was undertaken proved that the fistulæ related to the excluded part of the ileum, and that between the latter and the pelvic colon there was a communication. The cæcum and the ascending colon were highly distended, and packed with fecal masses (Fig 1). It is clear that the foregoing operation put the cæcum and the ascending colon into the position of complete bilateral exclusion. The ileum communicating with the rectum was not able to empty the cæcum. Through a coincidence this operation turned out to be identical with Montprofit's operation. Six months after the operation

FIG 18



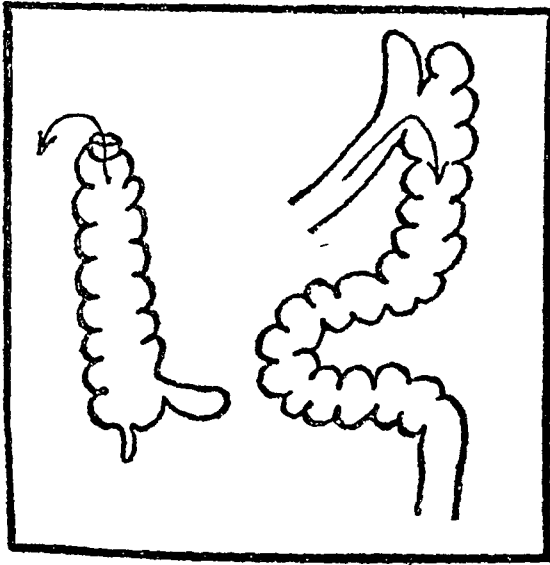
the excluded portion of the large intestine was found overfilled, that means, on the best way to perforation.

In the face of the above quoted facts it appears to me, that it is time to give up Montprofit's operation as an impracticable one. And yet, when it becomes impossible to bring both ends of the colon together after a resection, the resulting situation is very difficult indeed. Of course one might resect the ascending colon and cæcum without any deteriorating effect on the patient's health, by implanting the ileum into the left segment of the large intestine. However, the fear of an undue prolongation and complication of this *per se* difficult operation restrain us from doing so. The most practical way out seems to me to be the following plan: to combine ileocolostomy (with the descending colon) with division of the distal ileum. Ileocolostomy is more rational than ileosigmoidostomy, since it prevents the formation of a

cul-de-sac out of the descending colon On the right hand side is established a mucous fistula of the ascending colon, and the possibility is offered of a subsequent resection of the cæcum and ascending colon (Fig 19)

At the present moment we have to distinguish between three types of artificially established intestinal fistulæ (1) Mucous fistula, (2) fecal fistula, (3) artificial anus It follows from the aforesaid, that the mucous fistula is a direct sequel to complete exclusion, therefore.

FIG 19



nothing else remains to be said about it We have only to notice that in a series of cases mucous fistula becomes an alternative to a fecal fistula

Supposing we ought to resect the whole of the large intestine but, for some reason or other, the condition of the patient did not permit such a measure In such a case the large intestine may be either excluded unilaterally by means of ileorectostomy or ileosigmoidostomy, a fistula being established at the top of the cul-de-sac (Fig 20), or a method, which has been particularly favored by De Quervain and also consisting of ileorectostomy or ileosigmoidostomy, is carried out, the difference being here the division of the large intestine just above the anastomosis, its proximal end being brought to the surface, which means a mucous fistula is performed in the excluded bowel

I confess that the question just raised with regard to the choice

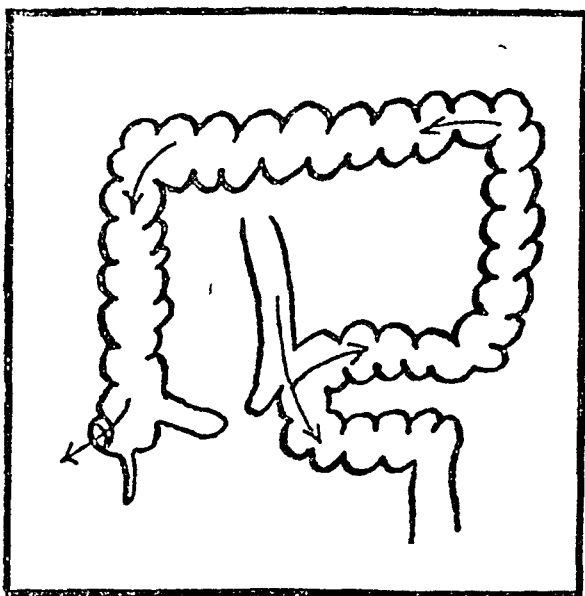
DISEASES OF THE LARGE INTESTINE

of the one or the other of these methods is open to discussion. In one of my cases I preferred to adopt the first method as being simpler and having the advantage of gradually preparing the patient for a subsequently limited function of his large intestine

Before I close the discussion on mucous fistulæ, I must add that one can distinguish two groups amongst them First, the temporary ones, when the excluded portion of the large intestine can be resected, second, permanent ones, where no resection can be taken into consideration, as is often the case in neglected cancerous, tubercular and actinomycoid processes

The grouping of fecal fistulæ slightly differs from the foregoing Fecal fistula is always temporary or, at any rate, ought to be such, a

FIG 20



permanent fecal fistula represents already an artificial anus, which, however, we will discuss separately

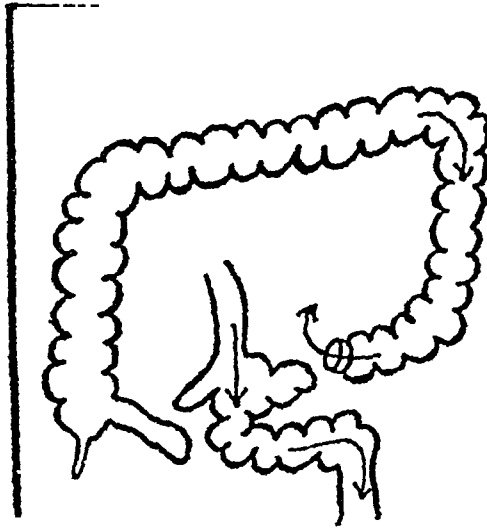
There are two types of fecal fistulæ The first type is represented by the auxiliary ones, if I may term them thus, which, for example, are established at the end of a cul-de-sac in unilateral exclusions The second type are fecal fistulæ, which we might term the self-existent ones, applied with the object of treating such conditions as ulcerative colitis and others I have already spoken about the first type, so that now I shall only consider the second one

From the typical fecal fistulæ, Weir's appendicostomy deserves special attention, as being very easily performed, and easily managed Its advantages have also been documented in the Russian medical

literature by Vanahoff and Fedorovitch. At present the application of appendicostomy is limited to cases of severe ulcerative colitis. I made use of appendicostomy as of an additional fistula, immediately after a complete unilateral exclusion of the large intestine. I think, however, that appendicostomy will before long receive a wider recognition.

Here I ought to touch on the delicate question of appendicitis. I hope it is not too audacious to say that a number of appendices removed *à froid* are not removed on account of appendicitis. The late Diakonoff demonstrated that morbid symptoms, in the region of the cæcum, sometimes remain after a radical operation for appendicitis. Rozanoff,

FIG 21



Wilms and Stierlin have quite recently attempted to solve this problem by assuming the existence of a *cæcum mobile*. I do not wish to argue that such a trouble exists, and that in cases with a marked mobility of the cæcum it is necessary to adopt cæcopexy, following the method described by Stierlin or Klose. There is, however, no doubt that in the definition of the disorder we have, above all, to consider the condition of typhlectasis. In my opinion, Rozanoff quite correctly endeavors to combat such dilatation of the cæcum by stitching it over.

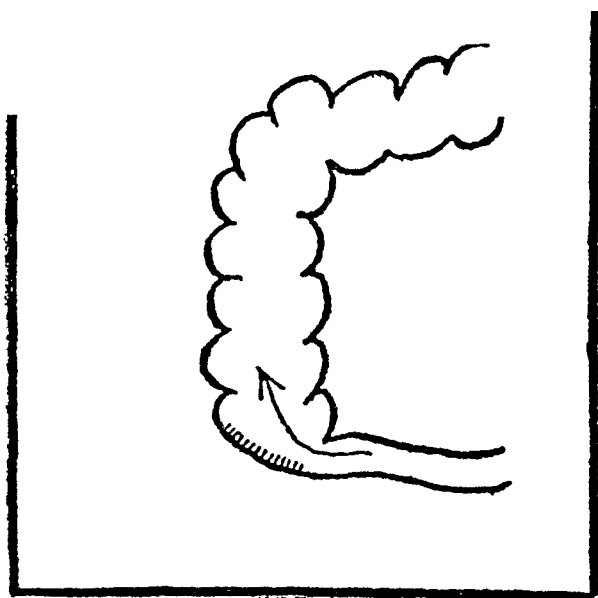
During the last three years, whenever I could, I systematically combined the resection of the appendix with an obliteration of the cæcum, by invaginating the latter so far, until its lower border became level with the lower border of the entering ileum (Fig 22). The problem, nevertheless, remains unsolved, because in the syndrom of symptoms

DISEASES OF THE LARGE INTESTINE

described by Rozanoff and Wilms, it is the typhlitis that still plays the first rôle. Through fixation or through obliteration of the cæcum we are able to influence the solution of typhlitis in a series of cases, but not always

Thus, a new problem arises. Would it not be better instead of removing the appendix to make use of it, by performing appendicostomy in those cases, where typhlitis is well marked and defying medicinal treatment, and in those cases, where the appendix is found to be normal, as well as in those cases, where typhlitis is not favored by any bends of the large intestine? I can foresee combinations which would render the application of appendicostomy difficult, for example, typhlectasy,

FIG 22



but, on the other hand, there still remains a series of cases where appendicostomy is more suitable than appendicectomy

Both operations preventing the danger of a subsequent acute appendicitis will differ in that after appendicostomy the whole of the large intestine is accessible to treatment. Since I am absolutely convinced that catarrhal appendicitis and typhlitis, in a great number of cases, are only part of the symptoms of colitis, therefore we may expect a great deal of good from appendicostomies

The observations of Fedorovitch and others show that appendicostomy applied in such troubles as dysentery, for example, does not always result in a cure, relapses sometimes making their appearance. Theoretically this may be explained by the fact that an intestinal fistula

does not put the large intestine into a condition of inactivity. And should such a condition be necessary, then appendicostomy does not appear to be sufficiently energetic a measure. Now, is such a condition of rest really necessary?

As I have said before, the complete unilateral exclusion does not immobilize the large intestine. But even if it did, I should not recommend it, as a rule, in cases of ulcerative colitis. The only patient I have lost through peritonitis following the exclusion of the large intestine, which was performed for a non-malignant trouble, was just the patient with ulcerative colitis. In mucomembranous colitis, according to my observations, ileosigmoidostomy, even when combined with a fistula of the cæcum, does not achieve its aim, since passing in the opposite direction the fæces must necessarily irritate the bowel.

Thus, when the diseased gut is considered useless and even harmful to the patient, then there remain only the complete bilateral exclusion and resection of the intestine. When it is desirable to preserve the gut, and to give it a period of rest, we have at our command only the artificial anus.

It is impossible to disagree with Lindenberg, who maintains that from a theoretical point of view a right-sided anus, that is, an anus of the cæcum, is more advantageous, because it immobilizes the *whole* of the large intestine. It is, however, less convenient to the patients. Roth and Nehrkorn, finding the chief pathological changes in the sigmoid in cases of ulcerative colitis, have preferred the left-sided anus, as being somewhat more comfortable for the patients. In order to decide this matter recourse has been had to statistics. Having added the figures of Nehrkorn and Lindenberg we get

From 20 left-sided ani	15 recoveries
From 28 right-sided ani	14 recoveries

We can hardly use such statistics as a guide in the choice of this or another mode of treatment. The individual investigation of cases has proved that sometimes not only the left-sided, but also the right-sided anus were of not much use.

Poucel, being unsuccessful in performing the right-sided anus, suggested an anus of the ileum. I have mentioned already a female patient, in whom after a series of operations the cæcum and the colon, which were subjected to a double exclusion and a fistula, became quite painless. Similar to this, the large intestine sometimes does not bear well the presence of fecal matter, and does not tolerate syringing, responding with painful contractions to the slightest irritation. All

our operative plans become frustrated through such complications, and, of course, eventually there remains only one issue, that is an anus of the ileum

I hope that the problem of the right-sided and the left-sided an will be cleared up in the course of time with the aid of a more exact diagnosis. For several reasons there are in the large intestines two most vulnerable places the cæcum and the sigmoid. Most of the pathological processes have here their origin, carcinoma, tubercle, actinomyces and colitis prove this beyond dispute. So that if ulcerative colitis affects the cæcum, then it is useless to establish the anus on the left side, and *vice versa*, in disorders of the sigmoid it is apparently more to the purpose to perform the anus on the descending colon

Having once touched on the question of the operative treatment of colitis, we are justified to raise the following question. Is the operative treatment of colitis altogether feasible? The solution of this problem is not, strictly speaking, within the scope of my present task, however, in order to avoid any misunderstanding, I shall briefly go into this matter. In my opinion a large number of cases of colitis ought to come under the care of physicians. Though certain types of colitis, for example, the mucomembranous, are only with difficulty amenable to treatment, and though the latter may last a considerable period, there is no reason whatever to hurry with operative steps. Only then when medical treatment being powerless and the condition of the patient becomes worse, operative measures are strictly indicated. I should even go a little further in such cases one ought not to protract the treatment too long, since a colitis, which in the beginning might easily be cured by a comparatively simple intervention, may in the later stages resist even more radical measures. The more so, as my personal observation has taught me, that frequently it is the anatomical position of the large intestine that through its abnormalities accounts for the incurability of the trouble, especially if the latter is of the local type. I believe more and more that an anatomically abnormal position of the large intestine predisposes to the origin, and supports the existence of all kinds of colitis.

Thus, our intention to immobilize the large intestine gives the first indication to the establishment of the artificial anus, and we desire to immobilize the whole of it in cases where the trouble is more widespread, partial immobilization being desirable if the trouble is more localized. To this is closely related the indication for the performance of an artificial anus, as a preliminary act before resecting or amputating

the rectum, for instance. The two just mentioned types of anæ belong to the group of the temporary ones.

A third indication is given when an overfilled bowel has to be emptied, that means when the symptoms of obstruction, especially of a malignant character, begin to appear. The experience of German surgeons, who were very enthusiastic about Mikulicz's "two step" resection of the large intestine, and who intended to resect the new growth and to establish artificial anus at the same time, emphatically speaks in favor of the fact that in cases of obstruction caused by malignant disease one ought to make an artificial anus, only an anus, and no more. Every surgeon can confirm the above statements from his own experience. Even here, though the operative steps taken are rather insignificant, mortality appears to be great. This becomes quite intelligible in view of the fact, that almost all these patients are in a moribund condition when operated upon. Let us look at the results of artificial anæ in cases of malignant obstruction.

Author	Number of cases	Number of deaths	Mortality
			Per cent
Schmidt	12	4	
Petermann	30	14	46
Paul	24	9	
Angschütz	37	19	35
Total	103	46	44

Also in this case, that is to say, when an artificial anus is made in order to relieve the obstruction, the anus may be either temporary, and the large intestine may subsequently be resected, or permanent, thus representing the ultimate surgical step of a palliative nature.

In discussing the operative treatment of the diseases of the large intestine I have frequently dwelt on temporary measures. I have thus discussed the temporary unilateral exclusion with formation of a fistula, the temporary complete exclusion, and the temporary artificial anus. The majority of these temporary measures are directed toward enabling us to perform resections of the large intestine with less risk for the patients, since it is just the resection which is really the radical measure. And then when there is no hope to cure the complaint without a resection, the latter, when practicable, gives the best results. Therefore the application of resection appears to be a very wide one, beginning with congenital malformations, such as the case of Prof. Trinkler, and such conditions which have a congenital predisposition,

for example, the *megacolon congenitum*, including benign and malignant new growths as well as inflammatory tumors of the bowels, the resection is applied also in cases of volvulus, and finally even directed against all varieties of colitis. Processes which necessitate the adoption of resections differ with regard to their extent, so that they even may spread over the whole of the intestine. The resection of certain portions of the large intestine, such as, for example, the transverse colon, brings with it a functional disturbance in the greater part of the large intestine. We have therefore first of all to consider the limits of the resection which are permissible.

Experimental pathology teaches us that in dogs we may remove the whole of their large intestine. The investigations of Lane inform us that also in men the whole of the large intestine may be resected without any danger. Hence it follows that the greater part of the large intestine can be removed without any harm to the patient, but often with great benefit. Two of my female patients are practically deprived of the function of the large intestine. It is clear that there remains very little of this function after a resection of the sigmoid, of the colon descendens, almost the whole of the transverse colon, with a fistula of the ascending colon; or after a resection of the transverse colon, as well as after a bilateral exclusion of the ascending colon and cæcum, with a fistula of the sigmoid. In spite of all that, however, I must confess that the absence of the large intestine does not in the least affect the patients. On the contrary, both of them feel much better without it than with it.

We take it for granted that it is still premature to decide categorically one way or the other the question of the significance of the resection of the large intestine. Nevertheless, the facts which we have at our disposal permit us to say that such extensive resections, as one-half to two-thirds of the colon, do not exercise any deteriorating influence on the health of the patient at all. This, however, is of great significance, since in performing a resection, on the one hand, care has to be exercised in order to prevent the formation of cul-de-sacs and portions of the gut closed at both ends, and on the other hand, it is often convenient to remove an extra piece of the bowel when it is either distended or packed with fæces, simply in order to diminish the risk of the operation.

Thus, for example, it is helpful in cases of tuberculous or malignant stricture of the hepatic flexure to remove the distended ascending colon and the cæcum in order to avoid infection. In this

respect I fully share the views expressed by Haberer. Moreover, physiology gives us the right to take such measures.

No doubt, the patients tolerate resections according to the character of the trouble. Simple inflammatory swellings of the large intestine as well as tuberculous ones may be removed without any particular danger. On the other hand, great resistance towards our measures is exhibited by patients suffering from malignant disease.

It is sufficient to glance at the figures I quoted to see that out of 10 resections undertaken on account of the so-called non-malignant troubles, I lost only one. Out of 6 resections of cancer, three ended fatally.

Such position of affairs made Mikulicz inclined to suggest his "two step" resection of the cancerous colon. I am not going to enter deeper into the discussion which arose in connection with the "one," as well as the "two step" operation. It seems to me to be quite sufficient to mention that having added all the figures, Finkelstein found that the "one step" operation shows 29 per cent mortality, whereas the other shows 16 per cent. Herefrom we have to draw the conclusion that for malignant cases, where the patients are greatly exhausted and where the tumor has attained a considerable size, we must give preference to the "two step" resection.

It has to be taken for granted, that every one of those troubles which are amenable to such treatment is capable of exhausting the patient to a high degree, thus lowering his vitality. It appears to me therefore that, although on principle preference is given to the "one stage" operation, as this does not leave any fistula behind, the "two stage" operation has to be applied in particularly feeble patients requiring very extensive resections. In short, the "two stage" operation always remains in reserve for such cases in which it is more advantageous to refrain from the "one stage" resection.

Besides the methods already described there exists, of course, the "many stage" resection. I do not object to it in the least; on the contrary, I am ready to support it, as I have myself suggested a "three stage" resection. However, to describe this in detail would entail a very minute discussion of the technic, which I should like to avoid as much as possible.

In conclusion, nevertheless, I ought to mention one or two points about the technic, since the latter throws some light on the results of my operations, of which I have quoted the figures above. Without criticising the methods of either Rostovtzeff or Moskowicz, I must add that so far I have not adopted them. I have always been making

use of the lateral anastomosis, when uniting the ends of the colon. In dividing the gut, I always first separate a portion of it from the mesocolon, and then I carry out two circular incisions as far as the muscular coat. Just outside these incisions and on either side of them, a purse-string suture is applied, a ligature is put around each of the incisions, and the gut is divided between them. After that the end of the intestine, swabbed with pure carbolic, is immediately pushed into the gut, and the purse-string suture tightened up. On top of that one or two layers of seroserous sutures are placed. It appears (and it is really so) that in the most extensive and most difficult resections, the instruments required are of the simplest possible kind. No special enterotribes, no particular types of clamps, besides those of Doyen, which are also only used in order to clamp the lumen of the gut to be divided, and no buttons whatever are necessary.

It is obvious that my results are far from being perfect, and the mortality of cancer cases is particularly high. I might be contented with the results achieved by the resections and anastomoses, which were carried out for other troubles. Anyhow, I do not expect any improvement of the situation through the use of more complicated instruments, especially in cases of malignant disease. I believe, however, that the results will become better, when the operative measures will be undertaken a little earlier than is the case now, that is, before the stage of cachexia has been reached. The operations will be thus rendered easier technically, they will be better borne by the patients, and will therefore yield better results.

PRIMARY SARCOMA OF THE LOWER END OF THE FEMUR INVOLVING THE SYNOVIAL MEMBRANE

WITH A CRITICAL REVIEW OF THE LITERATURE OF SYNOVIAL SARCOMA
REPORT OF ONE CASE WITH COMPLETE PATHOLOGICAL AND RADIOGRAPHIC EXAMINATION

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OF DENVER, COLORADO

AND

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IN considering the subject of primary sarcoma involving the knee-joint, it is a well-known fact among surgeons and pathologists that these sarcomatous growths of the lower end of the femur simulate tuberculous disease of the joint, and the differential diagnosis between tuberculosis and sarcoma of the knee-joint frequently presents difficult problems

Primary synovial sarcoma of the knee-joint is of such great rarity, as can well be judged by the meagre literature ^k upon this subject, that the writers wish to record their case and to review the literature of similar cases which have previously been reported. They consider that their case presents several very unusual phases of this interesting subject and, therefore, will report at some length, not only the clinical, but also the complete pathological and radiographic findings

The case which the writers are reporting was kindly referred to one of us (Dr Jones) by Dr Charles A Powers of Denver

History—A young girl of seventeen years presented herself for examination on October 30, 1913. She was one of four children and was born and had always resided in Colorado. She had lived a healthy out-of-door life and with the exception of the diseases of childhood, namely, pertussis, diphtheria and measles, her previous history as a young child was negative

When twelve years of age she was subject to severe attacks of muscular rheumatism, but there had never been any accompanying joint manifestations

Family History—The father is an active, healthy man and the mother is living and is in excellent health. There is no history of malignancy, tuberculosis or syphilis

Menstrual History—For the past four months, the menses had been very irregular. The flow at first was very scanty and later ceased en-

* We are indebted to Dr C D Spivak, of Denver, and to Dr F Robbins, of New York, for their aid in reviewing the literature

tirely When first seen by the writer she had not menstruated for two months The existing amenorrhœa was considered due to her present illness On pelvic examination the uterus was small and underdeveloped and was in extreme retroversion †

Present History—About the first of September, 1913, two months before seeking surgical advice, she noticed a slight swelling over the inner condyle of the right femur The pain which accompanied this swelling was intermittent in character, and was never severe

The motion at the knee-joint was at first not restricted, the skin was not reddened and there were no abrasions At this time her general health was excellent and she was able to attend school

In the early part of October, owing to the swelling and a beginning slight stiffness in the right knee, she consulted a masseur, who advised massage, electric light baths, and hydrotherapy, but at the end of a week there was no improvement and this treatment was discontinued

On examination, the patient presented a moderately swollen right knee, not symmetrical, the swelling being more marked over the inner condyle of the femur, and extending upward, three inches above the patella

She walks with a right limp, holding the knee in slight flexion

The leg can be extended on the thigh to an angle of 170 degrees, the flexion deformity being 10 degrees

Motion, both active and passive, is not painful There is no local heat and no redness of the skin On deep pressure over the inner condyle, pain is experienced The patella is freely movable and is not enlarged, and there is no joint crepitation There is a distinct patella "click" and there is fluid in the joint and in the synovial pouch under the quadriceps extensor tendon of the thigh Muscular spasm is present but is not marked There is slight atrophy of the calf muscles, but none of the thigh There is no displacement of the internal semilunar cartilage of the knee

The ankle- and hip-joints are normal The inguinal and popliteal lymphatic glands are not enlarged

Measurements—The right knee Above the patella is $13\frac{1}{4}$ inches, over the patella is $13\frac{1}{2}$ inches, below the patella is $11\frac{3}{4}$ inches

The left knee Above the patella is 13 inches, over the patella is $12\frac{1}{2}$ inches, below the patella is $11\frac{1}{2}$ inches

The circumference of the right calf measured four inches below the patella is $11\frac{3}{4}$ inches

The circumference of the left calf measured four inches below the patella is 12 inches

The circumference of the right and left thighs measures $14\frac{1}{4}$ inches

The length of the tibiæ of the right and left legs measures the same

The temperature is 98.4° and the pulse is 70

The hæmoglobin is 80 per cent and the red blood cell count is 4,260,000

The heart and lungs are normal

The radiographic examination made by Dr S B Childs, at the time of the writer's first examination, showed no bony involvement of either

† Gynæcological examination made by Dr C B Ingraham

articular surfaces of the tibia or femur or of the femoral shaft In the skiagram showing the lateral view (Fig 1) there is an increased shadow in the synovial cavity, more marked above the patella There is no roughening or thickening of the periosteum, and no areas of rarefaction

The anteroposterior view (Fig 2) shows no bony pathological lesion

The diagnosis was made of probable synovial tuberculosis and the patient admitted to the hospital for treatment

Absolute rest in bed was insisted upon and the affected limb was placed upon a double inclined plane with lateral immobilizing splints and twelve pounds traction applied to overcome the flexion deformity For two weeks decided improvement was noticed and no pain was experienced During the patient's third week in the hospital, the swelling increased, particularly in the synovial pouch under the quadriceps of the thigh The pain both on active and passive motion became very severe, more marked at night The flexion deformity had been overcome entirely and extension was complete The temperature was irregular, showing an evening rise of 100° to 101° , and the pulse, although of good quality, was increased from 80 to 100

There was no crepitation on motion of the joint and the inguinal glands were not enlarged

The presence of severe pain in the knee, even with the joint immobilized, the rise of temperature, the rapid distention of the joint with fluid, and the increase in the circumference of the knee, and the loss of appetite, aroused the suspicion of the writer that the case was probably one of malignancy and not of tuberculosis A tentative diagnosis was made of sarcoma of the knee-joint

The leucocyte count at this time was 15,200

Aspiration of the joint was performed on November 26, 1913, twenty-one days from the time that treatment was first instituted Two and one-half ounces of bloody fluid were obtained, free from pus and having no odor

This fluid was then injected by Dr Whitman into the peritoneal cavity and liver of a guinea pig and also microscopical smears were made of the aspirated fluid No pus cells or bacteria were found in these smears After an interval of seventeen days the guinea pig was killed and sections were made of the liver and spleen The microscopical examination showed these organs to be normal and no evidence of tuberculosis was present

Awaiting the pathological report, a more complete immobilizing splint was applied The pain in the knee greatly increased, the temperature was higher, the pulse was increased in rapidity from 80 to 110 but was of good quality

The leucocyte count was 16,000 The urine was normal

On December 13, a consultation was held with Dr C A Powers, and it was decided that an exploratory incision into the joint be made

On December 15, under ether anæsthesia, free lateral incisions were made on either side of the patella and the joint carefully explored Upon



FIG 1 —Skiagram showing the lateral view of the right knee. There is an increased shadow in the synovial cavity more marked above the patella. The articular surfaces of the tibia and femur are normal in appearance and no bony change is noted in the femoral or tibial shaft.

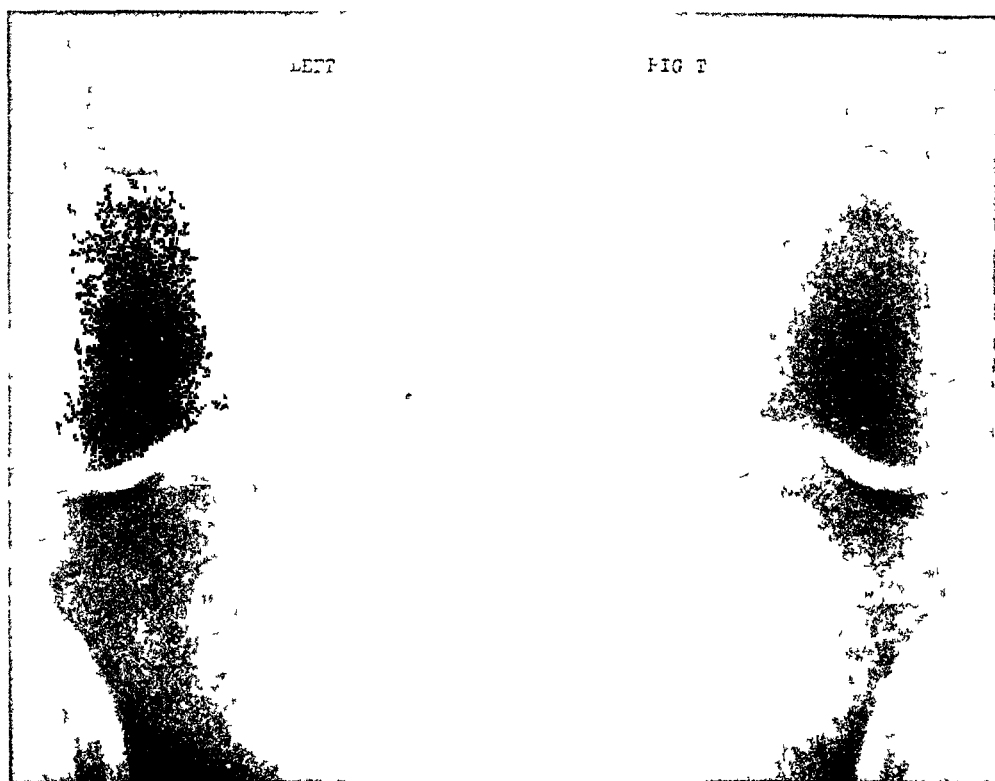


FIG 2 —The anteroposterior view of both the right and left knees. No bony change is seen in either the articular surfaces or in the shafts of the femur and tibia. There is no roughening or thickening of the periosteum.



FIG 3—Sclerogram taken of the amputated femur. The shadow of the femoral shaft is of uniform density except at the inner condyle where portions were removed for histologic examination. A marked involvement of the synovial cavity with a sarcomatous tumor is clearly demonstrated. The upper arrow points to the tumor involving the synovia and the lower arrow to the sarcomatous involvement of the internal femoral condyle.



FIG 4—Photograph of the longitudinal section of the femur. The dark area at the lower end of the bone shows the region involved in the sarcomatous growth. The synovia covered by tumor is seen at the right. Near the hand at the bottom of the photograph the involved inner surface of the synovial sheath can be distinctly seen.



FIG 5 —Photomicrograph of the tumor tissue from the bone marrow Zeiss apo obj 16 mm
comp oc No 4 Van Geisen stain



FIG. 6 —Photomicrograph of the sarcomatous tumor involving the synovia. The lower blood-vessel in the centre shows a definite endothelial wall. In the tissue between the blood-vessels are two tumor giant cells, one is mitosis. Other similar cells are found in the field. Below and toward the left the stroma is hyaline and blue staining (osteoid).

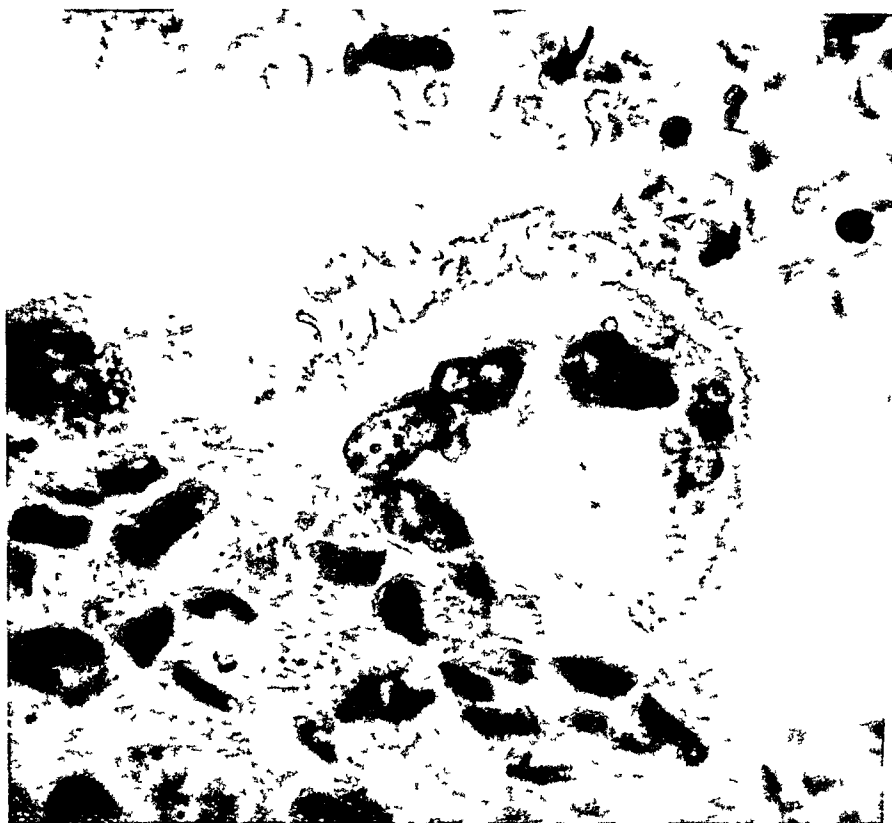


FIG 7—Photomicrograph of an endothelial or foreign body giant-cell living in the lumen of a vessel and attached to its wall. Zeiss apo obj 2 mm oil, comp oc No 4. Eosin and methylene blue staining.



FIG 8 —Photomicrograph showing three mitotic figures in the field. Near the upper right-hand corner is a very large mononuclear tumor cell with basophilic protoplasm and numerous protoplasmic processes. Zeiss apo obj 2 mm oil, comp oc No 4. Eosin and methylene blue staining.



FIG 9 —Photomicrograph of a group of yeast cell-like bodies of degenerative origin.

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incising the capsule and synovial cul-de-sac under the quadriceps, the joint and synovial cavity were found to be filled with a reddish-brown, friable substance, but no pus was present. Apparently the patella and articular surfaces of the joint were normal, but the space immediately above the inner condyle and in the intercondylar notch were eroded.

A frozen microscopical section was made at the time of the operation by the pathologist (Dr. Whitman), and showed this friable material to be sarcoma.

Owing to the patient's poor condition at the time of operation, it was thought wise to postpone amputation of the thigh for 48 hours. The wound was therefore packed with gauze, sterile dressings, and a posterior splint applied.

On December 17, Dr. Charles A. Powers performed a high thigh amputation, a small drainage tube was inserted and the wound closed with silkworm-gut sutures. The inguinal glands were removed for pathological examination and were found to be normal.

The patient's condition following the operation was very satisfactory and her convalescence was uninterrupted. During her remaining stay in the hospital she gained several pounds in weight, the temperature was normal, the pulse of good quality. The number of red blood-cells had increased to 5,120,000, and the hæmoglobin to 85 per cent.

She was allowed to return to her home on January 24, 1914, being able to walk about on crutches ‡.

Complete Pathological Report Gross Appearance—The tumor is a soft friable mass of a bright red color, 0.5 to 2 cm. thick, spreading over the outer surface of the synovial sheath, chiefly on the outer and on the posterior aspect. It also covers the front of the joint in the region of the knee. The inner aspect is involved only slightly and in the immediate neighborhood of the joint.

The inner surface of the sheath is smooth, gray, and shining. There are no adhesions of the sheath to the bone.

The bone itself is apparently involved only at the lower end of the femur. Here the bone is eroded in front and behind, between the condyles and extending upward and outward to form an irregular wedge-shaped opening, leaving a cavity filled with soft, pasty, dark reddish-brown tissue. The periosteum is intact to within 3 to 4 mm. of the edge of this cavity.

The tumor tissue removed from the marrow, fixed in 10 per cent formalin, decalcified, refixed, embedded in celloidin and stained with hæmatoxylin and eosin, Van Gieson, and Kresylect violet, presents, in addition to extensive coagulation necrosis and hemorrhage, the following features. Solid cell cords of varying width infiltrate the marrow, branching freely and fusing at points of contact to form anastomoses. Each cord of cells consists of an outer rim of small slightly spindle-shaped cells so arranged as to simulate closely the normal arrangement of osteoblasts. The cells are quite uniform in size, with round or very slightly oval vesicular nuclei, and a somewhat scanty eosin staining granular proto-

‡ Since reporting this case the patient died, in April, 1914, of metastasis involving both lungs.

plasm There are no giant mitoses or Langan's giant-cells Toward the deeper region of each cord the cells are more and more separated by intercellular substance which forms a loose open meshwork in the vacuoles of which the cells lie, one in each opening Here and there the meshwork becomes denser, lying in irregular branching collections of hyalin material This material stains red with Van Gieson or hæmatoxylin and eosin staining, but takes the basic stain in sections stained with eosin and methylene blue The resemblance to normal osteoid tissues is so close as to be startling

Tumor tissue from the synovia presents a very different picture This was fixed in Zenker solution, embedded in paraffin and stained with eosin methylene blue, aniline blue fuchsin, and phosphotungstic acid hæmatoxylin There is fairly abundant stroma of collagen, in which the cells lie singly and in small groups The shape and size of the tumor cell vary greatly, some being small and spindle-shaped, others very large, 40 microns or more in diameter, with large, irregularly shaped, bladder-like nuclei The protoplasm is relatively abundant in all cells, granular eosinophilic, but often containing minute basophilic granules which may be very irregularly distributed, giving the cell a curiously striped or blotchy appearance Many of the larger cells contain 2 to 4 or more irregular or oval nuclei Mitotic figures are abundant, often four or five being found in a single high-power field, very many of them atypical All these degenerative changes may be taken as indicating a relatively rapid growth and high malignancy as compared with the tumor in the bone marrow Hertzler²⁷ (*Treatise on Tumors*, p 109) mentions that metastases of endosteal tumors are frequently more malignant than the parent tumor In sections stained with phosphotungstic acid hæmatoxylin, fairly abundant delicate wavy fibrils can be made out, lying partly within the cell protoplasm, partly outside These are obviously imperfectly formed fibrogloma fibrils

In a few areas small masses of tumor cells become hyaline, presenting the picture of a very imperfect formation of osteoid tissue This is practically the only feature suggesting a common origin for the tumor in both sites

Blood-vessels, or blood sinuses rather, are abundant, large, tortuous, and freely anastomosing In many, a definite endothelium has either in whole or in part undergone irritative hyperplasia, becoming higher, plumper, and often desquamating into the lumen Not a few vessels contain giant-cells of the Langan type, attached to the vessel wall, and more or less surrounded by desquamated plump endothelial cells It is not always possible to distinguish with certainty between such endothelial cells and the neighboring tumor cells Nevertheless, there are no whorls or other evidence of neoplastic proliferation of the endothelium.

One of us (Whitman, *Journal Medical Research*, vol xxiv, p 465, 1914)¹⁸ has recently discussed the intravascular formation of giant-cells in tumors and in various other lesions, emphasizing the fact that the cells are not tumor cells, but endothelial in origin, and bear, to quote

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Ribbert, the same relation to the tumor cells that is borne by similar cells found in granulation tissue, etc., to the latter processes. In this case we have a tumor containing two types of giant-cells, one type being a true tumor cell, and important as indicating rapid and incomplete division of the cells, hence high malignancy. The tumor is a true giant-cell sarcoma. There are also present giant-cells not originating from tumor cells, but which are purely extrinsic, and which have no more voice in deciding the fundamental character of the neoplasm than the presence or absence of pus cells or of necrosis would have. It is greatly to be regretted that the clinician cannot more quickly and generally abandon a nomenclature based upon what is widely recognized among pathologists as a total misconception of the relation of the latter cells to these tumors. Mallory has recently emphasized the same important facts.

One other point deserves emphasis. In the paper above referred to, the wide divergence of opinion expressed concerning the malignancy of bone marrow myeloma was discussed and explained as due, in part, to the fact that some of these tumors are unquestionably of endothelial origin. Here we find a quite different explanation. Every one knows that many "giant-cell sarcomata" of the bone marrow are benign. Here we deal with one that is clearly highly malignant. Leaving quite open the question whether there is a corresponding difference in the point of origin (marrow cells in the one case, endosteum in the other, for example), one may state with all possible emphasis, and quite dogmatically, that a diagnosis of "myeloma" or "giant-cell sarcoma" does not in the least clear the air. Benignancy or malignancy must be decided for each case independently, and the diagnosis reached on grounds entirely separate from the presence or absence of endothelial giant-cells. The fact that the problems raised by border-line cases are often peculiarly difficult to settle only makes the careful study of all cases the more pressing a duty.

In view of the manifest non-involvement of the periosteum (save as a purely secondary matter) and of the osteoid character of the growth, we may conclude that the tumor is an osteoid sarcoma, endosteal in origin, of relatively slow growth within the bone, with early metastasis to the synovia, here manifesting so marked an increase in malignancy as to very closely simulate primary sarcoma of the latter tissue. For emphasis it may be repeated that some "giant-cell sarcomata" are benign and some are malignant, and that the giant-cell is of no weight in deciding this question.

The findings in this case must be regarded as impugning the authenticity of every recorded case of primary sarcoma of the synovia, in which there is no definite statement, not merely that the bone and marrow were normal, but as to how they were shown to be normal. Radiographic evidence alone regarding the bone marrow cannot be taken as conclusive.

The cuts with their accompanying legends will perhaps make clearer the chief points discussed in the text.

The case which has formed the theme of this report is of such unusual interest that it may be wise, in concluding, to emphasize the more salient features.

First, the fact that it is, so far as the writers are able to learn, the youngest case reported in the literature of a primary synovial sarcoma of the knee-joint.

Second, the great similarity of these cases between tuberculosis of the knee-joint, particularly of the synovial type, and synovial sarcoma.

Coley¹⁹ in his lucid and interesting article in the *ANNALS OF SURGERY* for 1907 says, "It may be quite impossible to make a diagnosis between these two conditions without the aid of a microscopical examination of a specimen removed."

The rapidly increasing amount of fluid in the knee-joint, the absence at first of pain and later the very severe pain coming on even after complete immobilization, the presence of an irregular temperature, with a marked evening rise, the increase in the pulse, and the character of the bloody or serosanguinous fluid obtained by aspiration, the absence of atrophy of the thigh and the slight atrophy of the calf muscles, the slight impairment of joint motion and the absence of crackling or crepitation on motion, are points to be deserving of special note.

Third, the radiographic findings which were negative at the time of the first examination, shown in both the anteroposterior and lateral views, forcibly emphasize the fact that, although every joint case should be carefully skiagraphed, it must be borne in mind, as pointed out by Coley, Stiles, Butlin and other observers that in these cases of sarcoma of the bones the X-ray frequently does not demonstrate pathological lesions present, and is very apt to be misleading. As in the writer's case, a negative skiagram should not be interpreted as positively excluding bone lesions.

Fourth, that careful pathological examinations should be made in every joint case before any radical surgical procedure be undertaken.

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Review of the Literature—A careful scrutiny of the literature finds that Simon,¹ in 1865, records the first case of primary synovial sarcoma of the knee-joint occurring in a man of forty-six years of age, who had complained of impairment of motion in the right knee for a period of six months. On the inner side of the knee was a mass 5 cm in diameter and $1\frac{1}{2}$ cm in thickness. This tumor was removed, and upon microscopical examination was found to be highly vascular, covered with epithelium and presenting many spindle and large, round, irregular-shaped cells, with oval nuclei. Simon called this tumor a "hypertrophied sarcomatous synovial fringe."

Two cases are added to the literature by Weir,² of New York, in 1886. His first case occurred in a woman of twenty-four years who presented a pedunculated tumor of the right knee-joint. An incision was made two inches long, the tumor exposed, the pedicle ligated and the mass removed. Microscopical examination showed the growth to be a giant-cell sarcoma.

Weir's second case was observed in a man of thirty-nine years of age. The tumor of the knee-joint was pedunculated, of irregular shape, and yellowish-pink in color. Upon careful microscopic examination the mass was found to be composed of connective tissue, containing blood pigment and many round and spindle-cells and was classified as a fibrosarcoma.

In both of these cases, following the operation, the patients made good recovery, and the joint function was completely restored, and no recurrences were noted.

Annandale,³ in speaking of the operative treatment of displaced semilunar cartilages of the knee, says that this condition sometimes simulates synovial growths of the knee-joint of sarcomatous origin. The author reports a case of myeloid sarcoma of the right knee occurring in a woman thirty-three years old. The tumor was movable and was situated in the region of the right semilunar cartilage and had been present for eighteen months. The mass was the size of a bean and was firmly adherent to the knee-joint capsule. The tumor was removed and eight years after operation there had been no evidence of recurrence or metastatic involvement.

Garre's⁴ contribution upon this subject concerned a woman of thirty-four years, who complained of pain in the left knee for nine months previous to the time that she sought surgical aid. The knee was enormously distended and the joint capsule greatly thickened and the pouch under the quadriceps extensor muscle of the thigh was filled with a consistent tumor which extended into the knee-joint and filled the entire popliteal space. The diagnosis was made of tuberculosis of the knee, and an operation was advised. Upon opening the joint capsule it was found to be greatly roughened and thickened and greyish-yellow in color, resembling "brain cortex." Amputation of the leg was performed, but two weeks later a mass appeared in the left inguinal region, metastatic in origin, and death occurred at the end of the fourth week. The necropsy findings showed a general sarcomatous metastasis, a diffuse sarcomatous infiltration of the joint capsule and also an extension along the femoral diaphysis and penetrating into the external condyle, with sarcomatous invasion of the bone marrow. The microscopical appearance was of a round cell sarcoma. Garré regards his case as one of primary synovial sarcoma with secondary changes in the bone marrow, but Baumgarten, in discussing the

case, believes that the original sarcomatous focus was in the bone marrow and had later involved the synovia

The writers have given a somewhat detailed report of Garre's case, as it very closely resembles the one which they are contributing

In the *Lancet* for 1894 an interesting case was reported by Hardie and Salter⁶ Their patient was a man of twenty-five years who complained of pain in the knee for a period of five years There was no history of injury to the joint Three years following the first symptom of pain he noticed a small "lump" the size of a marble on the outer surface of the knee At this time the patient met with an accident, falling upon the affected knee, which became swollen and very tender, requiring complete rest in bed and immobilization He sought admission to the Manchester Infirmary and aspiration of the joint was performed The fluid withdrawn consisted entirely of blood which had evidently been present in the joint for some time An incision was then made on the inner side of the joint and a large cyst was opened containing blood and blood clot, this cyst was separated from the joint by a thin layer of fibrous tissue and the joint cavity was found to be filled with "granular, roe-like material," and the synovial membrane slightly thickened and reddened Upon microscopical examination this "roe-like material" was found to be sarcomatous of the spindle-cell variety undergoing mucoid degeneration The limb was then amputated and the patient's convalescence was uninterrupted No metastatic growths were recorded

Again, in 1898, Marsh⁶ reported a case of primary synovial sarcoma before the Clinical Society of London The patient was twenty-seven years of age, who had complained of pain and swelling over the inner condyle of the femur, for a period of fourteen months The tentative diagnosis was made of tuberculous periostitis At the time of operation, this swelling was found to be a new growth involving the synovial tissue Curetting of the growth was performed and a microscopical examination made, showing the tumor to be of round-cell and mixed spindle-cell sarcoma A short time after this operation there was a recurrence of the growth first in the upper angle of the original scar, and later a mass was removed over the inner side of the knee-joint Amputation was then performed The great point of interest in Marsh's case is that the course of the disease extended over a period of nearly six years, showing that although the disease was one of fibrosarcoma of the synovia, it was a slow growing tumor

Lockwood,⁷ in 1902, adds one case to the literature, and Kruger⁸ contributes one case in 1903, and in the same year Bornemann⁹ reports one case occurring in a man of forty-five years

Julliard-Descoendres,¹⁰ in 1904, adds one case to the literature upon this subject. The patient was a woman of thirty-five years with an enormous cyst-like tumor of the knee-joint, which, when operated upon, was seen to have its origin in the synovial membrane Microscopical examination showed the tumor to be a small round-cell sarcoma with the presence of giant-cells Following the operation phlebitis occurred, resulting in death at the end of the fifth week The necropsy showed no metastasis or local recurrence v Ruediger Rydygier, Jr.,¹¹ published, in 1906, in a Polish journal, another authentic case of primary synovial sarcoma occurring in a servant girl of twenty years of age For two years previous to her consulting her physician, she complained of swelling of

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the left knee and difficulty in walking. There was no history of injury and pain was not present. The knee was aspirated and 1100 grammes of bloody serum were withdrawn. A second aspiration was performed a week later and 600 grammes of the same character of fluid were obtained. The skiagram was normal. The knee was resected, and solid bony union obtained. There were no signs of recurrence one year after the surgical procedure. Microscopical examination identified the tumor as one of small round-cell sarcoma. Rydygier, in speaking of these cases of primary synovial sarcoma, emphasizes the fact that motion of the knee-joint is only slightly impaired, although the swelling of the joint may be very great. The aspirated fluid is always bloody or serosanguinous and does not contain pus, and the inguinal glands are not involved. Crepitation on motion of the joint is absent, and the periosteum is not as a rule affected.

Burckhardt,¹² in 1909, describes his case as one of "primary sarcoma of the knee-joint capsule," occurring in a man of forty-six years, who had met with an injury to his left knee two years previous. The knee was swollen, and on the outer side of the joint and below the patella was a soft mass the size of an apple. An operation which consisted in removing the tumor, the ligamentum patellæ and part of the patella, was performed, and the wound healed by primary union. The tumor, although in close relation to the synovia, had not involved that structure. Burckhardt states that tumors arising primarily from the synovial membrane do not exist and that in his case, which was microscopically shown to be fibrosarcoma, the synovial membrane was normal. This case, therefore, according to the writers, should not be classified under primary synovial sarcoma of the knee-joint.

Schon's¹³ case, reported before the Danish Surgical Society in 1910, resembled in its early stages tuberculosis of the knee-joint. Following amputation of the thigh metastatic growths occurred in the pelvis. In the same year Lejars, Rubens and Duval¹⁴ record the case of a youth of twenty-two years who presented, on examination, a greatly swollen knee, the swelling apparently being confined to the soft parts. The skiagram showed a normal bone appearance, both in the shaft and articular surfaces of the tibia and femur. At the time of the operation, the entire joint cavity was found to be filled by a compact grayish mass without softening or abscess formation. The articular ends of the tibia and femur were normal, but at the level of the external tuberosity of the tibia there was an area of diseased bone 3 to 4 cm in diameter. This area was curetted and the synovia resected. Within one year recurrence took place and the thigh was amputated. The pathological examination showed the tumor to be sarcoma.

In St Bartholomew's Hospital Reports for 1910 is a contribution by Andrews and Branson,¹⁵ who exhibited a specimen of a left knee-joint, showing a sarcoma apparently originating in the synovial membrane. Microscopic examination showed the tumor to be a spindle-cell sarcoma. The case concerned a man of thirty-one years, who first began to complain of pain and locking of the left knee-joint when twenty-two years of age. The skiagram taken three months before the amputation of the thigh was negative. "A later skiagram showed the excavation of the patella." The most recent case found in the literature up to the present time was that reported by Blumenthal,¹⁶ in 1912, occurring in a patient of twenty-nine years of age. A curetting of the synovial membrane

and removal of a portion of the internal lateral ligament was accomplished, but no more radical operation was performed. This patient made a satisfactory recovery with a good range of motion in the knee-joint. The microscopical examination was found to be sarcoma of the spindle-cell variety.

A very careful and thorough search of the literature therefore finds but seventeen authentic cases of primary synovial sarcoma, which, with the writers' reports, adds one more case to the bibliography.

BIBLIOGRAPHY

- ¹ Simon Archiv fur Klin Chir, 1865, vol vi, page 573
- ² Weir, Robt The Medical Record, 1886, vol xxix, June 26, page 725
- ³ Annandale, Thomas Med Chir Society of Edinburgh, 1886-1887, vol vi, page 82
- ⁴ Garre Beitrage zur Klin Chirurg, 1891, vol vii, page 232
- ⁵ Salter-Hardie The Lancet, 1894, June 30, page 1619
- ⁶ Marsh, Howard The Lancet, 1898, November 19, page 1330
- ⁷ Lockwood Clinical Society of London, 1902, vol xxxv, page 139
- ⁸ Kruger, H Inaugural Dissertation, 1903, Leipsic
- ⁹ Bornemann Hospitalstidende Copenhagen, 1903, vol xi, page 823
- ¹⁰ Julliard-Descoendres Archiv Internat de Chirurgie, 1904, vol 1
- ¹¹ Ruediger-Rydygier, Jr Przegląd Lekarski Krakow 27 Stycznia 1906, Deutsche Zeitschrift fur Chirurgie 1906, vol lxxxii, page 211
- ¹² Burckhardt Deutsche Zeitschrift fur Chirurgie, 1909, vol 101, page 467
- ¹³ Schon Danish Surgical Society Hospitalstidende, No 40, 1910, Jahresbericht fur Chirurgie, 1911, vol xvi, page 852
- ¹⁴ Lejars-Rubens-Duval Revue de Chirurgie, 1910, vol 41, page 751
- ¹⁵ Andrews-Branson Saint Bartholomew's Hospital Reports, 1910, vol xlv, page 208
- ¹⁶ Blumenthal, M Deutsche Med Wochenschrift, 1912, vol 49, page 2305
- ¹⁷ Hertzler Treatise on Tumors, page 109
- ¹⁸ Whitman, Ross C Journal of Medical Research, 1914, January, vol xxiv, page 465
- ¹⁹ Coley, W B ANNALS OF SURGERY, 1907, March, vol xlv, page 321

A TREATMENT FOR OLD CONTRACTED CICATRICES *

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THERE is scarcely any condition in surgery that so tests the patience, ingenuity and skill of the operator as the treatment of old cicatricial contractures. Especially is this true if the cicatrices are hard, dense and of long duration. It is not my object to review what has been done in the past in the field of plastic surgery, as the method of procedure in each case must be determined on the local findings. In one case the division of contracting bands may suffice, in another the sliding, twisting or transplantation of flaps, to take the place of the excised cicatrices may be required. In still other cases, especially of the extremities, the deformity may be so great as to require amputation.

Are bad cicatricial contractures following burns as frequent as they were a generation ago? Our present-day text-books on surgery would lead us to believe that they are not, as little attention is given to this very important subject. Possibly we have improved in the treatment of burns, certainly, antiseptic dressings and early skin grafting has reduced to a large degree the late bad effects.

It is often difficult and sometimes impossible in cases of cicatricial contractures to get healthy flaps, and if one be so fortunate as to succeed, the result is always in doubt, as the flap may slough on account of a deficient blood supply.

In old, dense cicatrices, the result of deep burns, plastic operations are not without risk, as important structures, such as nerves and blood-vessels may be caught in the scar tissue and their anatomical situation so disturbed as to render injury almost unavoidable.

The case I wish to present to-night was not treated by the usual method of plastic surgery. In this case a plastic operation has been done at the wrist and axilla with much improvement, at the elbow, where an old firm cicatricial contracture existed, a good result has been obtained. This result has been obtained, not by the usual method of dissecting out the cicatrices and the lateral approximation of healthy skin, nor by the sliding, twisting or transplantation of flaps, but by operative, medicinal and mechanical means.

* Read before the Philadelphia Academy of Surgery, March 2, 1914.

E F, aged seventeen years, white, was admitted to the Episcopal Hospital on May 16, 1913, with the following history

At the age of 14 years he received a severe burn of the left side of the body, arm, forearm and hand. The patient was 18 months recovering from the burn. He was treated for ten and one-half months as an inmate in a local hospital in the town in which he lived, and for seven months after being discharged from the hospital, in their dispensary.

A physical examination of the patient on admission to the Episcopal Hospital showed the heart, lungs and other organs to be healthy. The left wrist was in extreme flexion, the joint ankylosed, and the overlying skin and cellular tissue consisted largely of scar tissue and contracting bands. The fingers could be freely moved. The thumb was partially ankylosed. The left elbow was markedly flexed and held by contracted bands of hard cicatrices. The left arm was held close to the chest wall by a large web of contracted scar tissue. The shoulder, chest and abdominal wall, and the latter anteriorly, showed contracted cicatricial tissue.

On June 12, 1913, a plastic operation was performed at the wrist, as his hand was so markedly flexed as to render it useless. At this operation an arthrectomy (first row of metacarpals removed) and a plastic operation were performed. The result was quite gratifying, as shown in Fig 1. An arthroplasty on the wrist is the next operation we intend to perform. One month after the above operation the patient was discharged from the hospital in the condition as shown in Fig 1.

On November 14, 1913, he was again admitted to the Episcopal Hospital, and on November 17, 1913, was operated upon and a plastic operation of the flap, sliding type, was performed on his axilla, the flap being gotten from the pectoral region. On his arm and forearm a different procedure was tried, many incisions were made along the contracting bands. These incisions extended into the healthy skin laterally and were of varying depth, some being quite superficial and others being deep enough to penetrate the cicatrices. After the wounds had ceased to ooze, fibrolysin, a compound of thiosinamine and sodium salicylate, was next rubbed thoroughly into each incision and also injected hypodermatically into the fibrous tissue. The wounds were covered with rubber tissue and a dry dressing applied. A straight splint, padded mould-shape to take up the concavity caused by the flexed elbow, was applied. The bandage holding the splint was firmly applied, so as to extend the forearm as much as possible.

For two days following the operation the patient complained



FIG 1 —A plastic operation has been done at the wrist Axilla and elbow show dense, contracted cicatrices



FIG 2 —End result

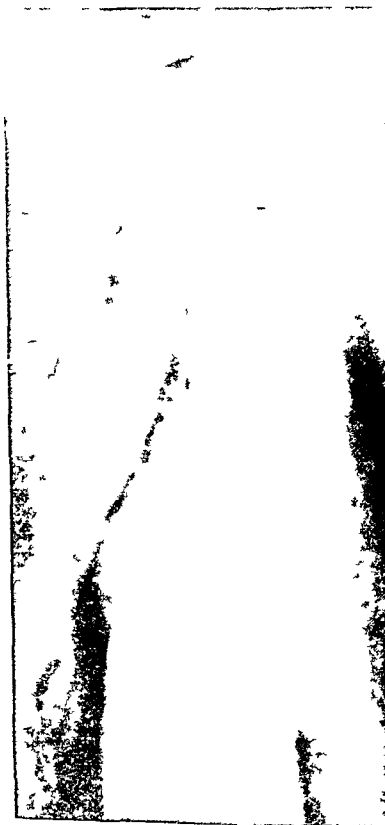


FIG 3 —Back view

of pain at the elbow This was undoubtedly due to the extension made on the forearm.

In one week's time quite an improvement was noticed The forearm could be extended fully fifty per cent further than it could before the operation and the cicatrices were soft and pliable

On December 4, 1913, the operation as described above for the administration of fibrolysin was repeated After this operation the patient experienced nothing like the discomfort which followed the first In ten days' time the arm was as straight as you see it now (Fig 2) At each operation the contents of four ampoules of fibrolysin were rubbed into the incisions and injected into the cicatrices

The after-treatment has consisted in the occasional injection hypodermatically of the fibrolysin into the site of the old cicatrices Passive motion and massage have also been given Three and one-half weeks following the second operation the splint was removed, but as the forearm showed a tendency toward flexion it was reapplied

It is as yet too early to say what the ultimate outcome will be, as the tendency to contraction after the splint was removed has made me a little skeptical No reactions were noted from the use of the drug

Richardson, *ANNALS OF SURGERY*, December, 1911, in an article entitled "Studies on Peritoneal Adhesions," discusses the results obtained by specific drugs in the treatment of adhesions and cicatrices He says, "Sidorenko has just reported the results of a clinical, experimental, and histological study of fibrolysin on cicatricial tissue From a critical study of the results of other workers, and from his own results, he concludes that it does not exert any therapeutic effect upon cicatricial tissue"

A H Tubby, *British Medical Journal*, November 8, 1913, described a method of treatment of Dupuytren's contracture by flap dissection, excision of the affected fascia and the use of fibrolysin While not following Mr Tubby's technic, it was from his article that I got the idea of using fibrolysin in the way as described in this case

Mr Tubby, in speaking of his operative results in the treatment of Dupuytren's contracture, says, that in every case they were "infinitely superior" to those in which the thiosinamine (fibrolysin) was not used

In the case just presented it is difficult to attribute the success to any one thing, as three distinct measures, operative, medicinal and mechanical were used That the cicatrices were rendered soft and pliable lends weight to the drug

LAMINECTOMY FOR SPINAL TUMOR *

A REPORT OF EXPERIENCES IN 37 CASES

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IN order to give a proper idea of the experiences of a single operator with the surgical treatment of tumors of the spinal cord and its membranes, it is necessary for him to report the cases in which tumors were found and removed, with the immediate and final results of the operative surgical interference, and to state in what proportion of the patients in whom the diagnosis of spinal tumor had been made, a tumor was found at operation. The purpose of my communication is to give a report of my experiences in this field, to tell of the errors we have made, of the lessons we have learned from our mistakes, and, finally, to describe certain technical procedures which I have found of value.

Among the last 100 spinal operations performed by me at the New York Neurological Institute, at Mount Sinai Hospital, and elsewhere, 58 patients were operated upon in whom the diagnosis of spinal tumor had been made, or in whom a growth could not with certainty be excluded. In a number of the cases, other lesions were considered more probable, but an exploratory laminectomy was performed in order to give the patient every possible chance. In 37¹ of the 58 operations a spinal growth was found.

The tumor was extradural in 4 cases, intradural but extramedullary in 19 cases, intramedullary in 9 cases, and malignant disease of the bone was found in 5 cases.

Excluding the 5 patients in whom a malignant disease of the vertebrae was found, for which nothing could be done, there remain 32 cases of true spinal tumor, 9 intramedullary and 23 extramedullary.

Of the intramedullary tumors, 8 were in the cervical and 1 in the upper dorsal region, of the extramedullary tumors, 5 were cervical, 10 dorsal, 1 lumbar, 4 involved the roots of the cauda equina, in 2 patients there were multiple tumors in the dorsal and lumbosacral cord and around the roots of the cauda equina.

* Read at the meeting of the New York Surgical Society, March 25, 1914.

¹ A histological study of the tumors will be published in the near future.

It may be of interest to first describe what was found in the 21 patients in whom the operation failed to reveal a tumor

In 5 patients, nothing was found to explain the symptoms; one of these patients was entirely and permanently relieved of his symptoms (decompressive effect of the operation)

In 5 patients the operation showed that we had to deal with a central myelitis or softening of the cord. These patients were operated upon a number of years ago. The operations were purely exploratory in nature and the possibility or probability that we were dealing with a central myelitis was recognized before the interference

In 4 patients a peculiar disease of the roots of the cauda equina was found. These patients presented the classical symptoms of tumor, but no tumor was found at the operation, the only lesion being a reddish-blue discoloration of the roots of the cauda equina. Several of the patients were much improved after the laminectomy and thorough washing out of the spinal canal. The cases have been described in detail in a paper by Dr. Kennedy and the writer (*Amer Jour Med Sci*, May, 1914), and we have called the disease "neuritis of the cauda equina." In several of our later cases we have recognized this disease and have been able to differentiate it from spinal cord tumor.

One patient, in whom multiple sclerosis was suspected, was enormously improved after the laminectomy. After having been bed-ridden for many months, he was able to be about and return to his work as an athletic instructor.

In 3 patients we were uncertain whether the disease was intramedullary or extramedullary. One of these proved to have an intramedullary cyst with diffuse syphilitic meningomyelitis, the second had a hydromyelia and was much improved by incision of the cord near the posterior median septum, the third suffered from syringomyelia and the incision of the cord was followed by marked improvement in the power of the upper extremities.

In 1 patient I found a localized serous meningitis, he was almost entirely relieved by the operation. In another, a peculiar abnormality of the posterior spinal vessels was found (see Fig 1), in a third, a hopeless malignant disease of the sacroiliac joint was discovered. The patient recovered from the operation, but succumbed to her disease several months later.

It will be seen from this summary of the cases in which no spinal tumor was found, that in 7 patients (33 per cent) complete relief or great improvement followed the exploratory operation. From these

cases, the conclusion is justified that even if a spinal tumor is not found at an operation, we may, nevertheless, discover a remediable condition or expect marked improvement in about one-third of the patients.

THE DIAGNOSIS OF SPINAL CORD TUMORS

Within the limits of this paper on the surgical aspects of tumors of the spinal cord and membranes, it would be impossible to enter upon a discussion of the symptoms and differential diagnosis of these affections. There are some special diagnostic features, however, which we have encountered and which merit a brief consideration.

I believe that a laminectomy is justifiable in many patients who have a progressive spinal disease with level symptoms, unless we are certain that there is a myelitis, a sclerosis, or a gliosis, and I have operated upon a number of patients in whom the history was totally unlike that of a spinal tumor, but in whom an easily removable growth was, nevertheless, found.

Thus, it is ordinarily stated that extramedullary spinal growths always begin with root pains, but I have three times removed tumors, pressing upon the cord, from patients who were very positive in stating that they had never had any pain during the entire course of their disease.

On the other hand, the generally accepted view that a painless beginning and the finding of dissociation of sensations, *i e*, loss or diminution of sensations of pain and of heat and cold, and preservation of sensation of touch, are characteristic of intramedullary disease will not hold for every case. I have operated upon two patients who gave a definite history of early and severe root pains, and in whom the physical examination failed to show dissociation of sensations, and who, notwithstanding, had intramedullary tumors of the spinal cord.

Therefore, the differential diagnosis between extramedullary and intramedullary tumor can not always be made with certainty, and the surgeon must be prepared for more than one surprise in this field of work.

The Brown-Sequard syndrome—most marked motor signs on one side of the body and most sensory disturbances on the other side—is often well marked in the early stages of tumors pressing upon the spinal cord, while in the latter stages, with complete paraplegia and complete loss of all sensations, very slight differences may indicate that signs of the Brown-Sequard character had previously existed. In the majority of instances the tumor lies upon the side which shows the

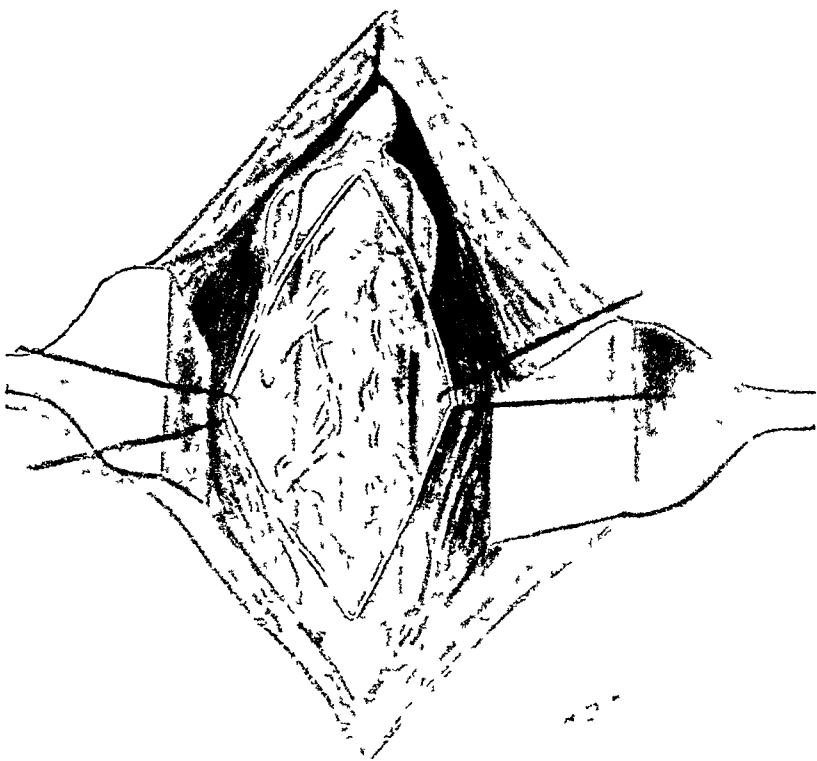


FIG 1—Frank C. Abnormal course of one of the posterior spinal arteries causing pressure upon the eighth and ninth posterior spinal roots on the left side. Laminectomy April 29, 1911

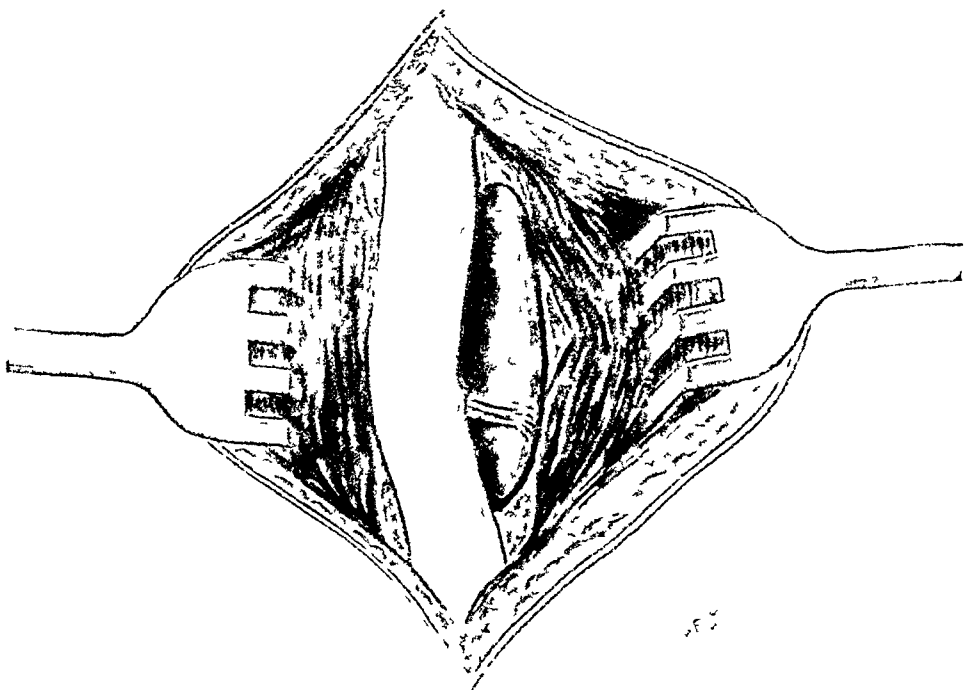


FIG 2—A. K. Extradural fibroma lying to the right and in front of the dura opposite the ninth, tenth, and eleventh dorsal vertebrae pushing the dura and spinal cord to the left and causing most marked pyramidal tract symptoms on the left side. Removed February 14, 1914

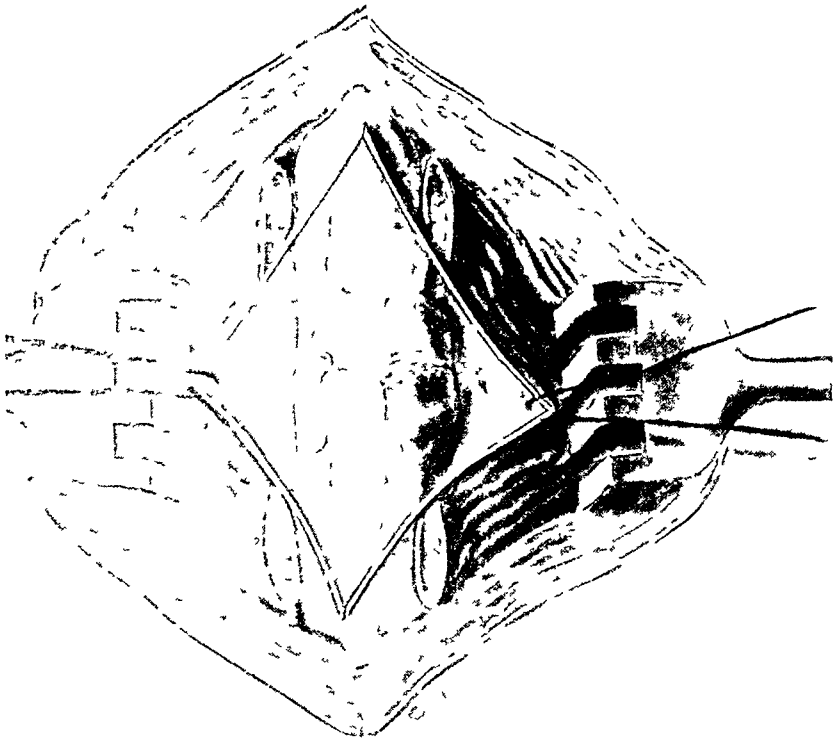


FIG 3—A R Extramedullary tumor at the level of the third dorsal segment which lies behind the dentate ligament Removed February 1914

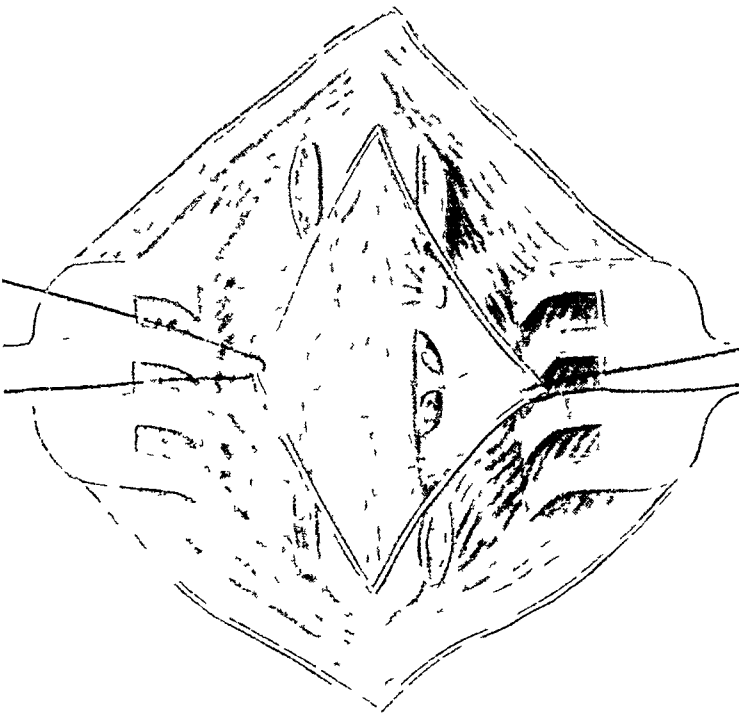


FIG 4—Mrs O Extramedullary tumor lying in front of the dentate ligament, and removed after division of the slip of the ligament

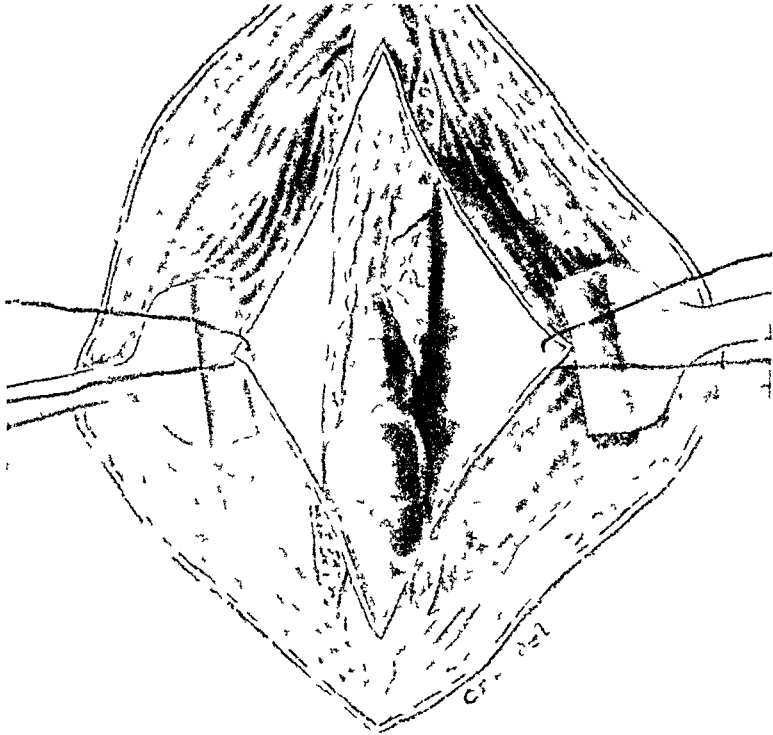


FIG 5—J W Pediculated extramedullary tumor arising beneath the pia Appearance of tumor
when dura was opened

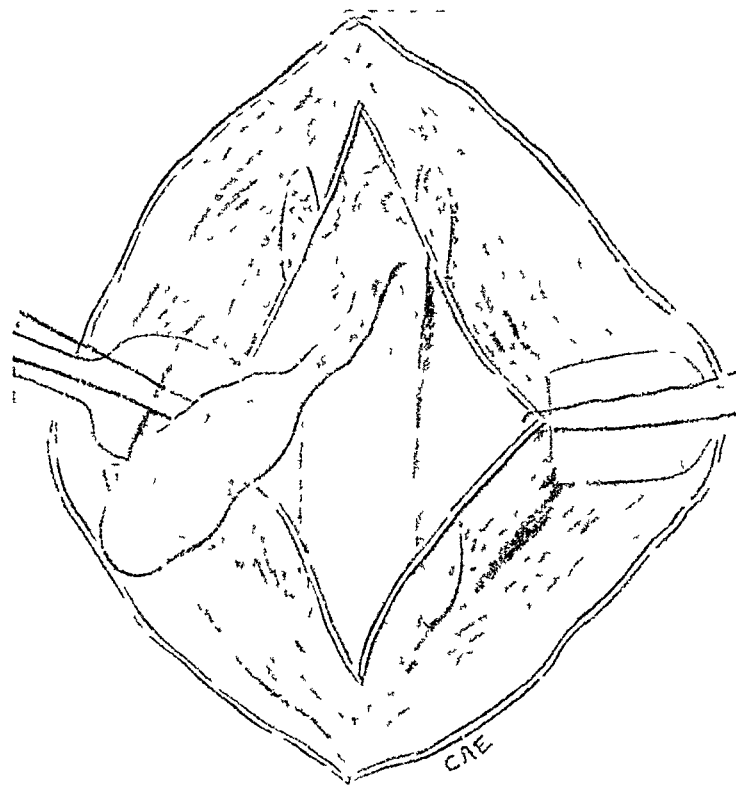


FIG 6—J W Tumor withdrawn from the dural sac but still attached under the pia mater above
The entire tumor proper hung free in the spinal canal

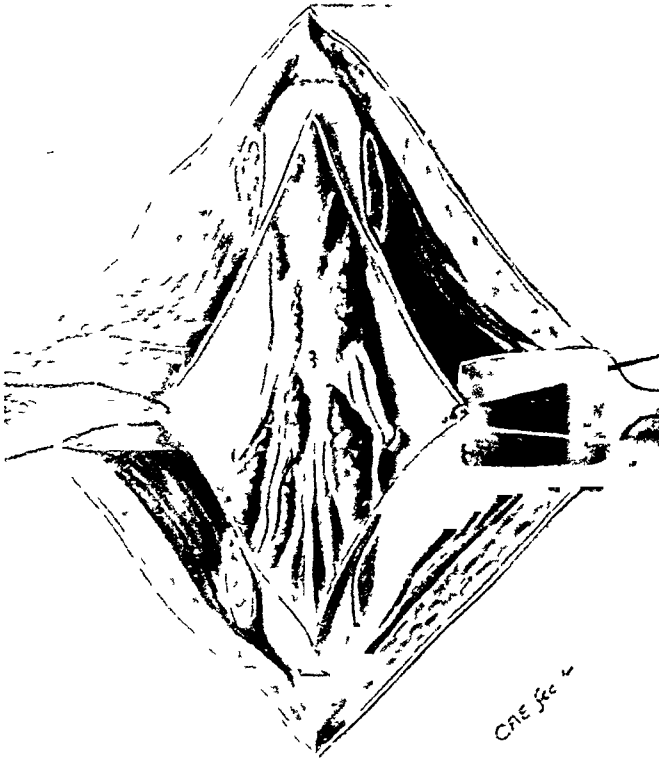


FIG 7—J L
the cauda equina
upward

Multiple extramedullary tumors of lumbosacral cord and between the nerves of
This is a type of sarcoma which grows in the pia mater and rapidly spreads

most motor symptoms. This is not always the case. In several instances I have operated and removed a tumor from a patient who presented both motor and sensory signs upon the same side, the side opposite to that on which the tumor lay (see Fig 2). The motor symptoms on the contralateral side must be explained by pressure dislocation of the cord to the other side and pressure of the pyramidal tracts upon the walls of the spinal canal. In other words, the same thing occurs as in cerebellar growths of one side which press the cerebellar hemispheres to the other side and cause the facial nerve of the contralateral side to be pressed against the petrous portion of the temporal bone, giving a facial paralysis on the side opposite to that of the lesion.

Indefinite sensory symptoms with well-marked motor disturbances occur either in tumors on the anterior surface of the cord or with extradural tumors. In three instances of extradural tumors the sensory disturbances were not prominent and varied considerably from day to day.

Extramedullary intradural growths most often lie in one of three locations, either upon the posterior columns, a little more to the one or the other side, or on the lateral aspect of the cord, behind or in front of the dentate ligament, or upon the anterior surface of the cord (see Figs 3, 4, 5, and 6). Tumors that lie in front of the dentate ligament will often cause little disturbance of the tactile sense but very marked diminution or loss of pain and temperature sense, and give symptoms very similar to those of intramedullary new growths. In several patients, in whom after a careful inquiry into the history of the disease and the sequence of symptoms, and after a number of painstaking examinations, the diagnosis of intramedullary disease had been made, an extramedullary tumor was found and removed at operation.

As my statistics show, the most frequent condition with which a spinal tumor was confused was inflammatory disease of the cord and of the roots of the cauda equina. After one has learned to differentiate between the clinical picture of a spinal new-growth and a meningo-myelitis, and between the symptoms of tumor involving the roots of the cauda equina and a caudal neuritis, the mistakes in diagnosis should become much more rare. Thus in the last nine patients in whom the diagnosis of spinal tumor was made, in eight the tumor was found at the operation.

In all but one of the patients with tumor that I have operated upon, the growth was found at the operation, in several cases, however, several vertebræ higher than had been anticipated. In one patient the tumor was thought to be at the tenth dorsal level on account of distinct

sensory level symptoms I failed to find the growth at this level. About one year later, there were symptoms referable to the first dorsal level, and at a second operation I removed a dural endothelioma at this level of the cord.

In most of my operations I followed the well-known rule, to expose the cord two vertebræ higher than the upper level of the sensory disturbances. I have, however, usually had to remove at least one spinous process and arch higher up, and I have recently made it a rule to make the middle of my exposure at least three vertebræ higher than the sensory level.

SPECIAL FEATURES OF THE TECHNIC

The spinal cord must be considered more delicate, if anything, than most parts of the brain. Its small size in which are crowded together groups of motor, reflex and trophic nerve cells and bundles of afferent and efferent nerve fibres, explains why the slightest trauma will be followed by extensive loss of function. The field of operation must be well exposed so that all manipulations can be accomplished without trauma to the cord. Such an exposure can only be obtained by means of a complete laminectomy, that is by the free removal of spinous processes and laminae. The operation of hemilaminectomy may have its field of usefulness, but it is not the proper procedure when the search for a spinal tumor is to be made, or a spinal tumor is to be removed.

With the proper instruments and after some experience, the removal of the spinous processes and laminae should be rapidly accomplished, in most cases three or four spines and laminae of both sides should have been removed and the dura exposed within ten to fifteen minutes from the time of the skin incision. If this part of the procedure is rapidly done, operations in two stages will be rarely necessary, except in high cervical operations, or for the removal of intramedullary growths by the method of "extrusion."

The best results will be obtained by those surgeons who are careful not to handle the cord and who consider that every time the cord is touched, harm is done to it. The cord should never be grasped with the fingers or an instrument. If it has to be lifted up or drawn to one side, it is advisable to grasp a slip of the dentate ligament with a "mosquito" artery forceps, to cut the slip at its dural end and to make traction on the forceps. It is sometimes necessary to cut one posterior root and use it for traction purposes.

As soon as the tumor has been found, and its relations to the cord determined, its removal should be accomplished with the utmost gentleness. The growth must be grasped with an instrument, and slowly pulled away from the cord so that its connections with the cord can be seen, and fine adhesions carefully divided. The entire procedure should be accomplished without causing any hemorrhage. If the growth is intimately connected with the pia mater or with the cord itself, it is better to stop the operation for the time being, rather than to attempt to peel out the growth. Some subpial tumors are closely connected with the cord, and their attachments cannot be divided without causing considerable trauma to the cord tissue. If the actual removal of the tumor is delayed for a few days or a week, the relations of the tumor to the cord will be found to have become much less intimate. In such a case it is advisable to leave the dura open, to close the muscles, fascia, and skin carefully, and to wait for four to seven days before the second operation is done.

I shall not, in this place, give any detailed account of the method of treatment of intramedullary growths, but would refer the reader to a description of the technic of removal of intramedullary tumors published elsewhere. I must emphasize one point, however, regarding the "method of extrusion." An intramedullary tumor can only be removed, if it has been completely extruded from the cord. If it has not entirely extruded, it cannot be removed, and it would be a great technical error (of which I have once been guilty) to attempt to peel out the part of the tumor that still lies within the cord substance. In the patient referred to, great improvement followed the incision of the cord and extrusion of the intramedullary tumor. At the second operation I found a small part of the growth still embedded in cord substance. Very carefully and slowly I peeled out the small intramedullary mass but the patient was again paraplegic after the operation, and years elapsed before she recovered the power in her limbs.

RESULTS

The only patients in whom we may expect a complete recovery, and by a complete recovery I mean the disappearance of all of the symptoms and of all evidences of loss or disturbance of function, are those who are operated upon early in their disease. We cannot expect a patient who has been paraplegic for many months or years to recover entirely, any more than we can expect a patient who has had a marked long standing choking of the disc from a brain tumor to recover without

some postneuritic atrophy. If the diagnosis is made early and the operation not delayed, complete recovery will occur within a short time, often only a few months. If more or less marked motor and sensory loss has existed, it may take years before all of the signs disappear, and some signs, such as ankle clonus, exaggeration of some reflexes, etc., may remain. If the pressure upon the cord has existed for many years, the cord may have been so much injured that improvement is impossible. Even if the pressure has existed for a number of years, however, considerable return of power and sensation may occur, although it may require many years for the improvement. There is nothing more unfortunate than to have a patient remain paralyzed, after the removal of an extramedullary growth has been easily accomplished, because the diagnosis was not made early enough. I have under my observation at the present time two patients from whom I removed extramedullary tumors a few months ago. One of the patients had symptoms for nine years, and the other had been paraplegic for six years. In both of the patients there has been some return of sensation in the lower extremities, but the paralysis had persisted, and I consider it doubtful whether power in the lower limbs will ever be regained. The real nature of their disease should have been recognized many years before.

Of the 32 spinal cord tumors that I have operated upon, two patients died as a direct result of the operative procedure. Both patients had intramedullary growths in the cervical region. In one patient, who was operated upon in very poor condition with respiratory and cardiac disturbances, an intramedullary tumor was removed from the fourth to sixth cervical segment by incision of the cord. The patient died from respiratory paralysis four hours after the operation. The second patient was operated upon for an intramedullary growth extending above the second cervical segment. The cord was exposed and incised and the tumor left to extrude. The patient died from respiratory paralysis on the second day after the operation, and the post-mortem examination showed that I had operated upon an infiltrating growth of the medulla oblongata and cervical cord, and that a large part of the tumor lay on the dorsal surface of the medulla in the posterior cranial fossa. The condition was, of course, an entirely hopeless one.

In considering the final results in the remaining 30 patients I shall speak of extramedullary and intramedullary tumors separately. Of the seven patients who survived after the removal or attempted removal of the intramedullary tumors, two have almost completely recov-

ered so that the patients are able to be up and about without assistance, and have returned to their work, two others have been slowly improving so that we may hope for a satisfactory recovery. At the present time (one and two years after the operations) both are able to get about with crutches and canes. Two patients died about six and eight months after the operation. Both of these patients had infiltrating growths which were not removed. Finally, one patient was operated upon two weeks ago, but the actual removal of the tumor has not yet been done. In short, of the nine patients with intramedullary tumors, the final result will be satisfactory in four, in two, the tumor could not be removed, two died as a result of the operation, one was recently operated upon.

Of the 23 patients with extramedullary growths, two must be excluded because they had multiple tumors which could not be removed, both patients died some months after their operations (see Fig 7). Two others died several months after they had been operated upon and in both patients it was found that the spinal growth was a metastasis from a tumor in another part of the body. Three patients had giant tumors which surrounded the conus and the nerves of the cauda equina and could not be radically removed. One of the patients improved very markedly after the operation, while the others remained unimproved (two, three and four years after the operation). These cases are reported in detail in a paper by Dr. Collins and the writer (*Amer Jour Med Sci*, April, 1914).

Of the remaining 16 patients, four were recently operated upon (two to four weeks since operation) and of these four, two have already shown marked improvement and will probably recover entirely, the other two patients have thus far improved but very little. There remain, therefore, 12 patients from whom extramedullary tumors were removed more than four months ago. Six of these patients are entirely well. They are free from all of their former symptoms and upon physical examination it is difficult to find the slightest evidence of the disease they had suffered from. In three other patients there has been great improvement, so that they are able to be about and attend to their work, although they still have sensory and motor disturbances. Finally, there were three patients who had had a complete paraplegia for a long period before the operation (four, six and nine years). One of these patients was operated upon about two years ago, she never regained the control over her limbs, and succumbed to bed-sores about one year after her operation. The other two patients

were operated upon about four months ago (six and nine years paraplegia) and they have not, and probably will not, regain any motor power

Thus, according to my experience, the danger of a laminectomy for spinal neoplasm is small, the results that may be expected from the removal of intramedullary tumors of the cord fairly good, if the tumors are well localized and will extrude, the results from the removal of extramedullary growths very satisfactory if only the patients come to operation early enough, before irreparable damage has been done to the cord

ANEURISM OF THE SCIATIC ARTERY*

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OF RICHMOND, VA

THE sciatic artery springs from the anterior trunk of the internal iliac and emerging through the great sacrosciatic foramen, between the pyriformis and coccygeus muscles, runs down the posterior aspect of the thigh parallel and slightly internal to the sciatic nerve. Aneurism of this artery is $3\frac{1}{2}$ times less frequently observed than in the gluteal, which is about the same size normally and situated more superiorly and internally. This condition is relatively rare, there being but 24 cases recorded.

CASE I (GUELLIOT, 1895. Anévrysme de l'artère ischiatique. *Bull Soc méd de Reims*, n s, v 1, p 31) —Man aged eighty, fell on buttocks and presented later a large descending ecchymosis as far down as the popliteal space and also down the penis. Ecchymosis gradually receded but the swelling persisted and the leg remained engorged. The tumor was as large as an infant's head, no pulsation. Incision of tumor. Clots of fibrin removed, bleeding soon refilled it however. An aneurismatic pouch was found at the level of the sciatic notch. It is probable that the aneurism was caused by fracture of the ischium incurred by the fall. Ligation and recovery.

CASE II (D'ANTONA, A, 1897. Un caso di aneurisma bilaterale nontraumatico della grandi sciatica. Ligatura dell' ipo-gastrica. *Atti d 1 Acad med Chir di Napol*, n s, v 51, pp 278-279) —Male aged fifty-two, negative history for syphilis. In 1890, he had attack of rheumatism. In 1895, pain in region of coccyx. In December, 1896, he observed a foreign body or tumor in right nates, size of a nut. It enlarged rapidly and became pulsatile. Incision near anterior superior iliac spine, location of common iliac, isolation and ligation of the hypogastric artery. Later he observed an aneurism the size of an almond in the left sciatic artery. He promptly applied the galvanic current and he is of the belief that the progress of the tumor was arrested.

CASE III (WOOD, W C, 1899. Traumatism of the Sciatic Artery Causing Aneurysm. *Brit M J*, Lond, v 1, March 18, pp 661-662) —Well-nourished woman, fell on fender about six months ago, injuring right buttock. Pain in the region of the tuber ischii at the time. Pain has been increasing ever since. Noticed a swelling in right buttock about six weeks before admission to hospital (St Mary's, London), and this tumor has been increasing gradually. Has had rheumatic fever, but no other illness.

*Read before the Sixteenth Annual Meeting of the Tri-State Medical Association of the Carolinas and Virginia, in Wilmington, N C, February 18-19, 1914.

Examination showed woman lying on left side with right leg moderately flexed, patient suffering pain referred to right buttock, but also extending down the thigh. Pulsation was plainly visible through the clothes. Buttock was much enlarged, pulsating, pulsation most marked a little above the gluteal fold. The superficial veins were prominent over the swelling. Steady compression caused diminution of the tumor, but it quickly regained its former size when released. Loud systolic bruit was heard over the whole area of the pulsation, and over its posterior part there was also a diastolic bruit, some numbness of the toes, no complete anæsthesia, a tendency to footdrop, but no paralysis.

On September 30, 1898, incision about 8 inches long was made over the swelling parallel with the fibres of the gluteus maximus. The muscle fibres separated and sac exposed. Estimated to hold about 14 ounces of blood, shape fusiform, and it extended from the sciatic notch downward behind the great trochanter to beyond the gluteal fold. It was separated from the surrounding structures without difficulty. The separation was about completed when the sac ruptured and half a pint or more of blood escaped. Tumor was grasped by Mr. Silcock with his right hand and the hemorrhage controlled to a considerable degree. Pedicle clamped and bleeding stopped. Sac was freely opened and its cavity packed with cyanide gauze. The upper end of the sac having been dissected out, a stout silk ligature was tied around the feeding artery and the mouth of the sac. The ligature unfortunately included the sciatic nerve, which, being firmly imbedded in the sac wall, and actually forming part of it, could not be freed. Patient lost about a pint of blood during the operation. Patient improved and was dismissed December 13, able to get about on crutches. There was complete motor paralysis of the foot and rather more on the outer half of the dorsum, including the four outer toes, extending up to the outer side of the leg to just below the knee, reaching to the middle line posteriorly, and rather to the outside of the middle line anteriorly, œdema of dorsum of foot and leg nearly to knee.

Examination of aneurism, short oval sac, $3\frac{3}{4}$ by $2\frac{1}{4}$ inches. Afferent artery enters on deep surface at upper end of sac. The efferent artery leaves on the deep surface about midway between the upper and the lower ends, it is completely fused with the sac as far as the lower end. The great sciatic nerve is represented by one stout strand of nerve bundles about the size of an average median nerve, on the deep surface of the sac, and on the superficial surface by two thin ribbons in which the nerve bundles are much separated. They are all intimately connected with the sac.

CASE IV (DUTTON, H. R., 1905. Gluteal Abscess with Aneurism of the Sciatic Artery. *Indian Med Gaz*, Calcutta, v 40, p 218).—Native Kuviraj, aged thirty, admitted to Cantonment Hospital, suffering from pain and swelling in right buttock. Carried to hospital, since he could not walk or stand, as he was unable to flex his thigh. Had suffered for two months. Said he never had fall, strain or other injury. No signs or history of tuberculosis.

Right buttock was found considerably enlarged, swelling greatest between great trochanter and ischial tuberosity, and extended within an inch of the iliac crest. Sense of heat present, and he complained of severe pain on pressure. Fluctuation obtained with difficulty. Thigh rigid and extended. Temperature 100° . Incision and removal of quantity of slightly sanious pus, while exploring a gush of bright red blood occurred and wound was packed with gauze, as patient's con-

dition did not permit any further interference About 32 hours after operation, complained of great pain, so he removed packing, irrigated the cavity and re-packed it. Sanious discharge continued, and on the eighth day another hemorrhage, packed again, hemorrhage recurred, decided to cut down and tie the gluteal artery if he could not find the bleeding point, tied gluteal artery, but bleeding continued Found a sacculated aneurism of the sciatic artery about the size of pigeon's egg Clamped sac with two pairs of Spencer Wells forceps and hemorrhage ceased Two days later all discharge ceased, forceps removed after 36 hours, patient discharged completely cured 18 days after second operation, with full use of leg again

CASE V (BAJARDI, DANIELE, 1898 *Aneurisma spontaneo dell' A ischiatic destra Legatura centrale e periferica ed escissione parziale del sacco Guarigione La Settimana med d Sperimentale*, Firenze, v 52, 22 gennaio, No 4, pp 37-40) — Male, aged fifty-six, good family history, and previous personal history fair, alcoholic and hard smoker, good general hygienic habits In September, 1896, he first noticed pain about the coccyx region and along the leg Slowly a tumor developed and a year later, August, 1897, it was diagnosed as an aneurism of the right buttock by Dr Nanni An incision down to the sciatic artery showed an aneurism of that artery Encountered some difficulty in separating the nerve from the aneurism Ligation of proximal and distal end of the artery and removal of portion of the sac Patient made a good recovery By October, 1897, he was able to be about No pulsation at the site of the operation, sensation had been restored, extension and flexor movements of the right foot were incomplete, however A little equinus remained but he was able to walk five or six kilometres without any trouble

States that he had collected from the literature ten true and three false aneurisms of the sciatic artery, eight traumatic and five spontaneous, they were treated one by compression, one by galvanopuncture, two by injection of perchloride of iron, two by forcipressure, three by ligature of the hypogastric artery, and two by ligature of the primary iliac artery Two cases were treated by expectant method, or simply palliative Seven died, five were cured and one improved

CASE VI (DUGAS, L A, 1860 *Aneurism of the ischiatic artery, ligature of this vessel, and subsequently of the primitive iliac artery Am J M Sc, Phila*, v 39, pp 572-573) — Male, aged twenty-two, first seen in March, 1857 Fell from tree when four years old, struck buttocks on rocky surface About five years later he first felt a little tumor in the region of the tuberosity of the ischium, which has been steadily increasing ever since Thinks it has been pulsating for several years

Tumor as large as a goose egg on inner cheek of nates, near tuberosity of ischium, and extended upward and inward in the direction of the ischiatic artery Firm pressure upon the seat of the ischiatic artery at its exit from the pelvis arrested both the pulsation and the whizz, and these returned when the pressure was omitted Tumor never caused pain except when he rode horseback, or sat a long time upon it Ligation of the ischiatic artery March 16 Did well until the twenty-fourth when he had a sudden hemorrhage from the wound while at stool Lost about a quart of blood before it could be stopped Ligation of the common iliac artery was done, but patient died from exhaustion No autopsy

CASE VII (STEVENS, W, 1814 A Case of Aneurism of the Gluteal Artery, Cured by Tying the Internal Iliac *Med Chir Tr*, Lond, v 5, pp 422-434) — Maila, negro woman, imported from Africa into the West Indies in 1790, was first seen in December, 1812, with tumor on left hip over sciatic notch. It was nearly as large as a child's head and pulsating strongly. Had commenced about nine months before with slight pain. Diagnosis was aneurism of the gluteal artery. Ligated the internal iliac artery about one inch from its origin. The tumor disappeared almost immediately after operation and the wound healed readily. At the end of the third week the ligature came away and in six weeks the woman was perfectly well.

Owen, Richard, 1830 An account of the dissection of the parts concerned in the aneurism for the cure of which Dr Stevens tied the internal iliac artery, at Santa Cruz, in the year 1812 *Med Chir Tr*, Lond, v 16, pp 219-235. The woman operated on by Dr Stevens in 1812 died in 1822 from chest trouble and Stevens had occasion to remove the anatomical parts related to his ligation of the internal iliac artery and brought them to the Museum of the Royal College of Surgeons. Examination showed that the internal iliac artery had become impervious at the part where the ligature had been applied, and he also found that the ischiatic artery was continued, in the character of a ligamentous cord, to the place of its exit from the pelvis, but that the gluteal artery was pervious at its origin. Here he discovered for the first time that the aneurism had been in the sciatic artery and not in the gluteal as he had thought.

In discussing a second operation on the internal iliac artery performed by Atkinson of York, he states that in his opinion this was also a case of aneurism of the sciatic artery. Male, aged twenty-nine, was operated on for gluteal (?) aneurism on May 12, 1817, was many days relieved from the distressing pain of the tumor, about the tenth day clots were extruded from the tumor wound and patient died from complete exhaustion May 31, 19 days after operation. On dissection, the ligature was found to be disengaged, the knot including a small fragment of (apparently) the artery, the internal iliac was completely separated.

"That the internal iliac was actually secured in this case, there can be little doubt, and if the vessel had been in the same healthy condition as in the negress Maila, the operation might have been attended with equal success. It is to be regretted that the nature of the disease in the coats of the vessel is not mentioned, and with respect to the seat of the aneurism, as it does not appear that the vessel from the distal side of the sac was traced in this dissection, nor any of the sound branches of the internal iliac artery, and considering the direction in which the bougie was passed down the internal iliac into the aneurismal sac, I am inclined to suppose that the aneurism in this case was also of the ischiatic artery."

CASE VIII—Richard Owen refers also to a case operated on by S POMEROY WHITE, of New York (Successful Case of Ligature of the Internal Iliac Artery) for the cure of gluteal aneurism (*Am J M Sc*, 1828, Art 5, p 304), where the operation was crowned with success, but Stevens, while in the United States, saw White, and was convinced that in this case also the aneurism was of the ischiatic, and not of the gluteal artery.

CASE IX—Case of J Van Volkenberg, aged sixty, trade of tailor, came to Hudson for surgical advice, October, 1827. Had a tumor size of child's head, located on left hip, directly over the sciatic notch. Stated that it was of ten

months' standing and that he experienced no pain from it History of repeated attacks of rheumatism

Skin was found discolored, fluctuation perceptible, no pulsation. Supposing that pus was contained in the tumor, incision was made with the result that bloody fluid escaped Probe was inserted and an aneurismal sac was found about five inches deep, the walls of the sac were found very thick and unyielding The orifice was closed, but filled with blood and the tumor reassumed its usual dimensions Ligation of the internal iliac artery was suggested and done and patient made slow but progressive recovery

CASE X (TILLAUX, 1879 *Sur un cas d'anévrysme traumatique de l'artère ischiatique Bull Soc de Chir de Par*, n s, v 5, pp 419-420) —Male, aged twenty, seen August, 18, 1878, having fallen down four steps, external bruises and fracture of thigh On the fifth day pain was noted in right trochanter and examination revealed a gluteal tumor Pains became violent and morphine was required for relief Deep fluctuation led to diagnosis of abscess Incision caused a stream of blood to flow, recognized his error and promptly made an incision down to large trochanter and sacrum Found the source of the bleeding in the sciatic notch The sciatic artery was involved Seized the artery with forceps, applied three ligatures Forceps were left in place for 48 hours Patient made good recovery

Tillaux was convinced that he had an ischiatic aneurism which he had mistaken for hot abscess.

CASE XI —NICAISE in the discussion of the above stated that he observed a similar case in a man, aged forty, about 2 years ago This man had fallen on his buttocks and in a short time there appeared a tumor of large size and painful Pain grew worse and, finally, paralysis of the affected leg (does not state whether right or left leg) caused him to cut down through the nates and remove clotted blood from a sac at the bottom of which he found a bleeding vessel, gluteal or one of its branches, located right in the sciatic notch Forceps applied for 48 hours Cure by secondary union in 20 days Every trace of the paralysis had disappeared

CASE XII —ANGER adds a third case in a young woman who had sustained a fall on the nates, followed by bloody effusion and inflammation, abscess suspected, physician incised and blood squirted out Anger was called and made a diagnosis of aneurism of the sciatic artery Ligation of the internal iliac. Death Autopsy showed rupture of the sciatic artery in sciatic notch down to base of pelvis

CASE XIII (NELLATON *Gaz d Hop de Par*, No 36, p 141, 27 mars, 1862, Richet, 1865 *Nouv dict de méd et de chir*, v 2, p 337) —Russian officer, aged forty-two, arteriovenous aneurism of ischiatic artery, size of fist, marked pulsation, constant bruit, two flaps on gluteal region and in pelvis felt through rectum Recognized later by Nelaton as aneurism of the gluteal artery In 1861 injection of iron chloride, repeated in 10 days Cure Richet asks the question whether it was gluteal or sciatic In March, 1864, no sign of tumor.

CASE XIV (BAUM, 1859 *De laesionibus aneurysmatibusque arteriarum glutaeae et ischiadicae Accedit descripto aneurysmatis per anastomosin dictarum arteriarum liquoris ferri sesquichlorati injectione sanati Diss Berlin*) —Female, aged thirty-two, aneurism per anastomosis of gluteal and sciatic artery, began four years ago when she was taken in the fifth month of pregnancy (2nd) Three

years ago during the third pregnancy it was the size of fist; and 18 months ago during the fourth pregnancy, it had grown still more Aneurism occupies the greater portion of the left gluteal region, covered with one nævus and six varices Pulsation, whirring, possible dilatation of the common pudendal On November 10, 1858, injection of ferri sesquichloride Cure confirmed 8 years later

CASE XV (SAPPEY, C, 1850 Anévrisme de l'artère ischiatique, ligature de cette artère *Gaz d'hop de Par*, 3 s, v 2, pp 105-106) —Male, aged fifty-five, left sciatic aneurism Fell on nates at age of twelve years, 14 days later there was observed a nut-sized, painful and non-pulsatile tumor, remained for 10 years At age of twenty-two the tumor was hen-egg size, pulsatile, remained so for ten years more At age of thirty-five sudden increase to size of two fists, painful Aneurism lay over tuber ischi, pulsatile and bruit noted August 27, 1849, compression for 14 days was found to be useless, then ligation of the sciatic artery (Anel), aneurism grew again, pulsation returned, was the same two months later, but painless.

Conclusions In aneurisms of the ischiatic artery he prefers to open the sac after the method of Anel

CASE XVI (NÉLATON, 1864 Anévrysme de l'artère ischiatique *Gaz d'hop de Par*, 19 mars, pp 130, 178) —Sappey's case recurred in 1864 Aneurism size of fist noted on inferior portion of sciatic artery On March, 1864, injection with ferric chloride Anticipates radical cure A month later the patient was improving markedly

CASE XVII (RIBERI *Opere minori*, v 1, p 326) —Male, peasant, aged twenty-five years, varicose aneurism of sciatic artery of right nates Was injured with a scythe about a year previously Considerable hemorrhage which was arrested by pressure Pulsatile tumor developed along course of sciatic, interferes with walking In 1833 compress applied for 3 months Recovery In 1838 the tumor was as before, compression again Improved again (reported the case in October, 1838)

CASE XVIII (BALSUS, E (Dr Halle), 1859 Eigenthümlicher Schmerz beim Glutaal-Aneurysma, *Deutsche Klinik*, No 11, pp 10-106) —Male, aged fifty, circumscribed aneurism of the sciatic (ischiadica) Injured while riding in saddle Tumor hen-egg-sized for over a year opposite incisura ischiadica Severe pain along sciatic nerve At first supposed to be abscess, pulsation confirmed the diagnosis In 1849 galvanopuncture with too weak current and too short treatment Died from cholera before treatments were finished Autopsy not obtained

CASE XIX (RUYER, 1845 Anévrisme de l'artère ischiatique gauche pris pour un anevrisme de la fessiere, mort autopsie *Gaz méd de Par*, v 13, pp 184-185) —Female, aged sixty-six, robust, aneurism of the left ischiatic artery due to a fall on buttocks in 1821, small painful tumor, in 1825 she sustained two falls on nates, pain, hen-egg-sized tumor, pulsatile In November, 1825 (time of report), operation was contra-indicated, due to weakness, age, and size of the tumor Palliative treatment with morphia and digitalis, fever and severe pain in leg Died February 3, 1826 At autopsy Rousson held that it was an aneurism of the sciatic artery

CASE XX (HILTON, FAGGE C, 1864 Case of aneurism seated on an abnormal main artery of the lower limb *Guy's Hosp Rep*, 3 s, v 10, pp 151-157) —Widow, aged forty-eight, fat, good health up to three months ago when she

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began to complain of a dull, aching pain in middle and posterior part of right thigh, which gradually increased in severity Leg began to swell ten days ago. Patient could not move about Pain at inner and lower part of tuber ischii; some hardness and swelling, pain also shot into vagina and labia, suggillations, severe pain, formication, deafness, diarrhoea, weakness Died September 23 Autopsy showed ruptured aneurism of the sciatic artery which runs posteriorly on femur down to popliteal space, above between tuber ischii and trochanter major

CASE XXI (KADE, E, 1876 *Aneurysma der Art ischiadica Unterbindung der Art iliaca communis sinistra Petersb med Wchschr*, v 1, No 8, pp 2-5) —Male, aged fifty, gave history of tumor on left nates for a year, but no history of fall or other injury Tumor caused pain, interfered with locomotion and work Two months ago he experienced a sensation as though something had burst, tumor increased in size at its original site and extended down to calf of leg, and both malleoli felt hot and gave rise to constant pain Examination, July 2, 1874, showed pulsatile tumor, left buttock larger than right, upper thigh also larger than right Diagnosis of aneurism of sciatic artery was made

Elevation of leg and ice applied constantly No improvement July 15, 1874, ligature of left common iliac artery Removed about 7 pounds of coagulated material from sciatic aneurism, this was followed by bleeding from sac. Tamponade with sterile gauze Died three hours later Autopsy showed that ligature was complete and perfect, and bleeding from aneurismal sac must have come from anastomotic source Patient died from exhaustion, although the bleeding had been effectively stopped by packing the wound.

CASE XXII (CIANFLONE, 1875 *Legatura dell' arteria iliac intera per ferita di un ramo della glueta* Reported by Pasquale Landi *Lo Sperimentale-Firenze*, v 35, pp 121-147) —Female, aged forty, admitted September 29, 1851, to Ospedale degli Incurabili, spontaneous aneurism of left nates size of head of child, calling for ligature of hypogastric artery Died 17 years later from gangrene abscess of pelvis Autopsy showed that the sciatic aneurism occupied the ischiotrochanteric space

CASE XXIII (MONTAZ, LÉON, 1891 *Des anévrysmes de la region fessière. Congres Franc de chir*, Par, v. 5, pp 444-448) —Male, aged thirty-five, entered hospital three years ago, complaining of painful tumor in right gluteal region This tumor had increased in size and was situated at iliotrochanteric line, size of fist Pulsatile, hard, round tumor, both systolic and diastolic murmur or bruit Diagnosis of arterial aneurism of sciatic region in man with sclerotic arteries. Injection of half Pravaz syringe of ferric chloride into aneurismal sac Thrombosis of leg, dry gangrene of foot, disarticulation a la Chopart Good recovery. Aneurism grew progressively smaller and symptoms disappeared. Patient was able to get along very well with his stump

CASE XXIV (D'ANTONA, 1903 *Caso di aneurisma bilaterale omonimo delle due ischiatiche Legatura delle due ipogastriche Guarigione Arch Internat de Chir*, Gand, v. 1, pp 69-73) —Rare case of bilateral aneurism of both sciatic arteries in male, aged fifty-two In 1896 he observed sensation as of foreign body in right nates, tumor size of a nut, pulsations In December, 1896, cedema of right foot Tumor limited to sacro-iliac synchondrosis and large trochanter, external margin of glutei and large sciatic notch Systolic bruit pronounced Ligation of the hypogastric artery The aneurism rapidly diminished

ROBERT C BRYAN

in size Recovery by the seventeenth day On February 10, similar tumor and pulsation in left side noted For three weeks galvanic current, dismissed March 16, 1897. At the end of 1901, symptoms returned, pain was then very severe In July, 1902, ligature of the left hypogastric artery, good recovery

Operation	Year	Sex	Age	Etiology	Operation	Result
Guellhot	1895	M	80	Fall	Ligation sciatic	Cured
D Antona	1897	M	52		Ligation hypogas- tric	Arrested
Wood, W C	1899	F		Fall	Ligation sciatic	Recovery with pa- ralysis
Dutton H R	1905	M	30		Clamp sciatic	Cured
Bajardi D	1898	M	56		Ligation sciatic	Recovery and pa- ralysis
Dugas, L A	1860	M	22	Fall	Ligation common iliac	Death
Stevens W	1830	F			Ligation internal iliac	Recovery
Atkinson	1817	M	29		Ligation internal iliac	Death
White, S P	1828				Ligation internal iliac	Recovery
Van Volkenberg	1827	M	60		Ligation internal iliac	Recovery
Tillaux	1879	M	20	Fall	Ligation sciatic	Recovery
Nicaise		M	40	Fall	Ligation and incision	Recovery
Anger		F		Fall	Ligation internal iliac	Death
Nélaton	1865	M	42		Injection ferri chlo- ride	Recovery
Baum	1859	F	32	Preg- nancy	Injection ferri ses- quichloride	Recovery
Sappey C	1850	M	55	Fall	Compound ligation sciatic	No cure
Nélaton	1864				Injection ferri chlo- ride	Improved
Riberi	1833	M	25	Blow	Compression	Improved
Blasius, E	1859	M	50	Riding	Galvanopuncture	Death
Ruyer	1845	F	66	Fall	Medical	Death
Hilton F C	1864	F	48			Death
Kade E	1876	M	50		Ligation common iliac	Death
Cianflone	1875	F	40		Ligation hypogas- tric	Death
Montaz Léon	1891	M	35		Injection ferri chlo- ride, gangrene, amputation	Recovery
D Antona	1903	M	32	Bilateral aneurism	Ligation right hy- pogastric, ligation left hypogas- tric	Recovery

An analysis of the above series shows 7 females, 18 males, youngest 20 years, oldest 80 years

Injection ferri sesquichloride	1 case
Injection ferri chloride	3 cases
Medical treatment	1 case
Compression	2 cases
Clamp sciatic	1 case
Galvanopuncture	1 case
Ligation common iliac	2 cases
Ligation hypogastric artery	4 cases
Ligation internal iliac	5 cases
Ligation sciatic artery	5 cases

No improvement	1 case
Recovery with paralysis	2 cases
Recovery with amputation	1 case
Improvements	3 cases
Deaths	8
Recoveries (one case bilateral)	. 11

To the above cases I wish to add

CASE XXV (Bryan) —A boy, L A , twenty-two years old, colored, was referred to me by Dr George Ross of this city in December, 1913. Examination showed a rather anæmic, thin mulatto, who, unable to sit down, was lying on his bed upon his right side with the left leg and thigh flexed and supported by pillows. He complained bitterly of pain down the back of the thigh, in the knee, and foot, which had required generous doses of opiates to relieve him. It was interesting to get his history, for being a waiter he migrated with the seasons between the Canadian border and the Gulf States. Early in October previous to his injury, while *en route* by boat from Portland to Florida to take up his migratory duties, he went to sleep on deck. In the night a severe storm came up and he was tossed about for some time before being awakened by a sharp blow over the left gluteal region, which made him sore for two or three days. This soreness gradually disappeared and it was not until November that he noticed an enlargement and stiffness about the spot where he had received the blow.

The family and previous personal histories were negative. He denied any venereal taint, no Wassermann was taken. The lungs were negative, temperature normal, there was no murmur of the heart, although a slight accentuation of the second aortic was noted. No blood count was made and there was nothing of any significance about the urinalysis. Rectal examination was likewise negative.

On inspection the left gluteal region posteriorly showed a large swelling shading off into the tissue both above and below. It was extremely tender, so much so that the tumor could not be mapped out, although a distinct pulsation and a moderate thrill could be elicited. The skin was glazed and reddened from numerous applications, the gluteal fold was smoothed out and on the first appearance it seemed as if an extensive suppurating cellulitis of the left nates was the cause of the trouble. Percussion was unsatisfactory. Auscultation gave a moderate systolic bruit synchronous with the heart.

The diagnosis seemed to lie between aneurism and hygroma. On account of the rapid development and the history of trauma, aneurism of the gluteal artery was suspected.

On operation a wide curved incision was made, starting above the trochanter major of the left femur, and running with the gluteal fold as far as the inner margin of the buttocks. The tendon of the gluteus maximus was severed and thrown back with the skin. The tumor could now be felt lying in the notch between the tuber ischii and the great trochanter, as a fusiform, pulsating aneurism springing from the sciatic artery. Some of the inner fibres of the gluteus medius were now severed, the long axis of the tumor was vertical, the upper pole emerging into the sacro-iliac foramen, having displaced the muscles and tissues there upward and separated the notch considerably. Along the inner margin and over the posterior wall of the aneurism were stretched the thinned-out fibres of the sciatic nerve to the width of about $2-2\frac{1}{4}$ inches.

The fibres of this nerve were collected, dragged to the inner side, the tumor dissected free from above, and tied off as closely as possible, well into the notch, the inferior pole being more easily reached was likewise tied off double, and tubes were put in the large space for drainage left by the removal of the tumor.

The aneurism measured 8 inches in circumference at its largest diameter and $9\frac{1}{4}$ inches about its bipolar circumference. Both the afferent and efferent stems were on a posterior plane to the sac which was symmetrical, dense and adherent (see Fig 1).

The patient developed an infection which kept him in the hospital altogether for five weeks, he ultimately made a perfect recovery and left the hospital with no paralysis and perfect use of the leg.

It has been noted that both spontaneous and traumatic aneurism of the sciatic artery occur more frequently in the male than in the female in proportion of two to one. Most of the patients are between 20 and 40 years of age in the laboring class and apparently otherwise healthy. It has also been established that aneurism of the sciatic artery occurs more often on the left side than on the right.

D'Antona emphasizes the following. A line between the top of the great trochanter and posterior inferior spine of the ilium is a distinct landmark and separates gluteal aneurism which lies above, from sciatic aneurism which lies below this line.

He also calls attention to the location of the bruit in reference to this line.

D'Antona further states that a differential diagnosis between aneurism of the gluteal and sciatic artery is at all times difficult and in most instances impossible.



FIG 1 —Aneurismal sac one-half size

ANEURISM OF THE SCIATIC ARTERY

Fischer says that aneurism of the gluteal lies high, as a rule, above the tuber ischii and to its inner margin, while that of the sciatic is deep, and at, or below, the level of the tuber ischii

Fischer also calls attention to the fact that with marked pulsation of the tumor along the posterior border of the femur, increased thickness of the deep femoral and low pulse of the cruralis, one should bear in mind a possible ischiatico-popliteal aneurism

D'Antona lays particular emphasis on an early neuralgia, in cases of aneurism of the sciatic artery, on account of its normal anatomical relationship to the larger sciatic nerve. This obtained markedly in the writer's case and appears to be a strong diagnostic symptom for aneurism of the sciatic artery.

He also refers to the hard œdema which goes along with sciatic aneurism and which is produced by a vasomotor paralysis or vasodilating excitation which is not noted in the gluteal aneurism

Traumatic aneurisms, following stabs, gunshot wounds, or a fall, may be diffuse, circumscribed or varicose and are more rare than the spontaneous aneurism, whose history is negative to any injury but, in a certain percentage of cases, goes on to the formation of anastomotic aneurism

Fischer, George (*Die Wunden und die aneurysmen der Arteria glutea und ischiadica. Arch f Chir. Langenbuck, Berl*, v. 11. pp 762-838), states that the differential diagnosis between aneurism of the gluteal artery, abscesses, cysts, and cancer, is always difficult and in some cases impossible

Diagnosis of aneurism of the sciatic artery must be based mainly on the complex of pulsations, bruits with aneurismal character, and sciatic pains which can be brought out in this region. Differential diagnosis should consider abscesses, hygroma, sciatic hernia, gumma, cancer (markschwamme) and pulsating sarcoma.

Abscesses In this region abscesses may be deep-seated, arising in the sciatic space by retroperitoneal involvement and extruded downward through the notch from above, or, more rarely, by way of the bowel. The rectovesical fascia, however, would appear to be a sufficient barrier against the escape of suppuration from the ischiorectal space to this locality. The superficial phlegmons and cellulitis are to be recognized by local evidences with constitutional reaction. Rectal examination in both instances should be carried out

Bursæ Various authors describe 31 bursæ about the hip-joint. Those which may be justifiably confounded with sciatic aneurism are:

- 1 The bursa of the gluteus maximus, which is located between this muscle tendon and the great trochanter, inflammation of this bursa is

not uncommon, and gives rise to a doughy tumor behind the great trochanter with eversion and abduction of the thigh in contrast to the flexion and inversion of aneurism

2 The bursa over the tuber ischi which is small, rarely involved, and points internal toward the anal margin along the lower fold of the buttocks

3 The bursa of the gluteus medius developed in the tendon of that muscle as it runs over the upper and outer margin of the great trochanter Inflammation here may be noted anterior and external to the trochanter

Sciatic hernia Garré gives two forms of sciatic hernia, the hernia suprapyriformis and the hernia infrapyriformis In both the intestine protrudes beneath the gluteus maximus and is deeply buried

Most sciatic herniæ occur in women past middle life Beside the intermittent pain which goes hand in hand with all varieties of hernia, in this instance there is a tumor below the gluteus maximus which is *reducible* with subsidence of the pain Not infrequently these herniæ point inward to the anal margin and even to the coccyx

Gumma Should always be suspected and a thorough investigation instituted

Malignant growths of any type may arise in this region, as nearly every form of tissue is represented here Of the many varieties, pulsating sarcoma offers the greatest obstacle to differential diagnosis In myelogenous sarcoma, pulsations and bruits are not infrequently present True aneurism of bone, however, is extremely rare Klebs reports no such case Vibrating or pulsating sarcomata are due to great vascularity and cystic degeneration

The prognosis of aneurism of the sciatic artery is extremely profound Spontaneous cure is not to be expected in any case Very rarely does aneurism of this artery remain stationary It may for a year or so, but fatal hemorrhage will result some time, and sudden rupture may cause death following a gradual asthenia D'Antona has collected the figures of the mortality following ligation of the hypogastric artery and found it to be 40 per cent The mortality of the cases in our series, surgical and medical, was 32 per cent

The treatment must be surgical Ligation of this artery was practised by Muzell as early as 1754 (*Med u Chir Wahrnehmungen*, 2 Samml, 1 Aufl, 1754, 2 Aufl, Berl, 1772, pp 37-39) He states that a musketeer had been stabbed in the gluteal region with scissors, resulting in the formation of an aneurism Muzell cut down and ligated what he called the obturator artery, but Fischer feels assured that it was

ANEURISM OF THE SCIATIC ARTERY

the sciatic and not the gluteal artery as some other writers (Lisfranc, Velpeau, Boisson) seemed to think. Paralysis of the leg followed operation, but locomotion was completely restored in time, and Fischer is convinced that the paralysis was induced by injury to the sciatic nerve during operation. The fact of the proximity of this nerve would seem to further confirm his view.

Splitting of the sac with ligature of the sciatic, the hypogastric, internal iliac and common iliac arteries, galvanopuncture, injection with ferric chloride, compression, and Valsalva's clamps have each been tried in specific instances. The injection of ferric chloride is recommended by former writers as the best method of treatment on account of its simplicity, greater safety, less danger and shorter duration of confinement. According to these authors it gives stable cures and has been found peculiarly efficient in various spontaneous arterial and anastomotic aneurisms of the gluteal artery.

With our present knowledge of asepsis, a surgical wound has none of its former terrors. It would not seem feasible or practicable to attempt, upon this unimportant, terminal artery, the finer surgical means for obliteration, such as suture, Halsted's gradual occlusion, or the use of his aluminum band, the Moore-Corradi wiring operation, or the Matas endo-aneurismorrhaphy.

The large death rate attending ligation of the common and internal iliac arteries would contraindicate this heroic measure until other means have been tried.

The sciatic artery, although deep-seated, is accessible by free incision. Excision of the aneurism should be attempted in each instance as the method of primary choice. The permanency of cure, liberation of the sciatic nerve, satisfactory results, and low mortality indicate, from a review of former cases, that this method will be attended with the most gratifying outcome.

INJURIES OF THE GREAT TOE SESAMOIDS

BY KELLOGG SPEED, M D.

OF CHICAGO, ILL

A BRIEF anatomical review of these small bone seeds (sesame) is necessary, as they are seldom considered either clinically or anatomically. They are more common in males than females and also in those of active muscular habit, and the ones under consideration beneath the metatarsal phalangeal joint of the great toe, while the largest in the human body with the exception of the patellæ, are but one set in the series of sesamoids found in the whole body.

The great toe sesamoids beneath the joint mentioned, like all sesamoids, develop in tendons which are subjected to great pressure over parts on which they glide. Their whole surface is invested by fibrous tissue derived from the tendon, except that area lying in contact with the part over which they play, namely, the upper surface which has an articular facet. On the plantar surface of the great toe metatarsal are two grooves, one on each side, for the sesamoids which develop in the tendons of the flexor brevis hallucis. The lower or plantar surface is convex, the upper surface is flat where they articulate in the grooves in the head of the metatarsal. A strong transverse ligamentous band unites them. From the lower surface this is smooth and forms a channel along which the long flexor tendon passes. The connection to the base of the phalanx is by strong fibres, much stronger than those to the metatarsal bone. Laterally they are bound to the lateral ligaments of the great toe joint and the sheath of the flexor tendons.

Causes of sesamoid injury are usually (1) direct violence due to a heavy object falling on the foot, (2) squeezing of the great toe joint between heavy masses, (3) falls from a height striking full weight on foot, (4) sudden increase in weight-bearing force when carrying heavy objects and missing footing with force expended through great toe joint.

When the foot and toe have been subjected to trauma or crushing, the injury to the soft parts or the toe alone may demand all attention. Such an injury would be cared for surgically and later, after it was healed, when the patient came to bearing weight on it, the tenderness at the base of the toe would increase with use and finally, if the efforts at use were persistent, end in disability. Physical examination reveals little, but by finding the same point of tenderness over the head of

DISAPPEARANCE OF MAMMARY CARCINOMA

The question came up whether, in the presence of these metastases, it was worth while to operate upon the fibromyoma. On the basis of my former experience with Beatson's operation I expressed myself in favor of it. A panhysterectomy with removal of both ovaries was performed by Dr. Seeligmann, after which the patient made an uninterrupted recovery and left the hospital. We saw nothing more of her until December 3, about 8½ months after the operation, when a member of the house staff who had seen her, kindly referred her to me. Not a trace of the nodes can be found, they have completely disappeared.

In my series of cases formerly reported there was improvement in every case, in one of them the growth disappeared almost completely. The tumors, however, began to grow again after the lapse of six or seven months, sometimes sooner, in every case except one. In that case the tumor, which had been firmly fixed to the chest wall, became so loose that I performed the radical breast operation about two months after the removal of the ovaries. I saw that patient as late as fifteen months after the operation without any signs of a recurrence that I could detect. She was then suffering from severe headaches, and a few months later I heard that she had died suddenly. I am unable to say whether she died from a metastasis within the skull or from some entirely different ailment. It is possible, therefore, that there was one cured case among my former series.

The effect of castration upon mammary carcinoma had always been ascribed to some peculiar relation between the ovaries and the milk glands. The carcinomatous nodes in the present case were in the skin and subcutaneous tissue and had not appeared until more than four years after the breast had been removed. It had also been claimed by some that Beatson's operation is most likely to do good in women who are still in their menstrual life. In my former series, however, the best result, the almost complete temporary disappearance of the tumor, occurred in a woman who had passed the menopause. In this respect the present case stands in a rather unique position, for, although she is fifty-seven years old, she menstruated regularly up to the time when her ovaries and uterus were removed.

It seems that the operation of castration in these cases should not be entirely relegated to the heap of therapeutic rubbish, where most of us have placed it, but should be remembered in cases where we are unable to do anything better.

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A BRIEF anatomical review of these small bone seeds (sesame) is necessary, as they are seldom considered either clinically or anatomically. They are more common in males than females and also in those of active muscular habit, and the ones under consideration beneath the metatarsal phalangeal joint of the great toe, while the largest in the human body with the exception of the patellæ, are but one set in the series of sesamoids found in the whole body

The great toe sesamoids beneath the joint mentioned, like all sesamoids, develop in tendons which are subjected to great pressure over parts on which they glide. Their whole surface is invested by fibrous tissue derived from the tendon, except that area lying in contact with the part over which they play, namely, the upper surface which has an articular facet. On the plantar surface of the great toe metatarsal are two grooves, one on each side, for the sesamoids which develop in the tendons of the flexor brevis hallucis. The lower or plantar surface is convex, the upper surface is flat where they articulate in the grooves in the head of the metatarsal. A strong transverse ligamentous band unites them. From the lower surface this is smooth and forms a channel along which the long flexor tendon passes. The connection to the base of the phalanx is by strong fibres, much stronger than those to the metatarsal bone. Laterally they are bound to the lateral ligaments of the great toe joint and the sheath of the flexor tendons.

Causes of sesamoid injury are usually (1) direct violence due to a heavy object falling on the foot, (2) squeezing of the great toe joint between heavy masses, (3) falls from a height striking full weight on foot, (4) sudden increase in weight-bearing force when carrying heavy objects and missing footing with force expended through great toe joint.

When the foot and toe have been subjected to trauma or crushing, the injury to the soft parts or the toe alone may demand all attention. Such an injury would be cared for surgically and later, after it was healed, when the patient came to bearing weight on it, the tenderness at the base of the toe would increase with use and finally, if the efforts at use were persistent, end in disability. Physical examination reveals little, but by finding the same point of tenderness over the head of



FIG 1—Crushing injury great toe Note distal phalanx mashed and external sesamoid under metatarsal bone broken across After soft parts healed man had great pain beneath this joint and was disabled completely Fragments slightly separated



FIG 2—Side view of Fig 1 showing the enlarged sesamoid While this is the external bone its shadow can be seen greatly overlapping the normal bone and its pressure effect understood



FIG. 3—The area removed from this case. On the left side corresponding to the skiagram is the fracture. View is of the plantar side and this enlarges the actual size about three times. A complete and painless resumption of function in foot followed in two weeks.



FIG. 4—Fracture of internal sesamoid left foot. This was by slipping while carrying weight and is almost exactly transverse.




FIG 5 —Side view of same. Note the greatly enlarged bone button which caused great pain and disability for several months before true condition was realized




FIG 6 —Fracture of internal sesamoid right foot, due to squeezing violence

In removing these I make a lateral incision well above the heavy plantar skin, about 2 inches in length, along the outer surface of the great toe joint. The plantar flap is reflected downward and dissection made inward, keeping just proximal to the line of the joint. By careful palpation through the plantar skin the bones can be located. They should be dissected out, both from the fibrous covering of the tendon, without opening the joint structures. Both should be removed, for if one is left without its companion support it would soon become the source of irritation on account of its localized pressure. Deep tissues are closed by catgut and skin by horse hair or clips. As soon as stitches are removed, the patient in bearing weight will find that no pain results. After twelve to fourteen days ordinary occupation can be resumed.

Of the five cases given here 4 are of the internal sesamoid. This I believe can be explained by the fact that the external bone lies a little lateral to the head of the metatarsal bone and is not directly subject to the pressure trauma or sudden increase in weight-bearing force. The case given in which the external or lateral bone was broken was due to direct violence in the nature of a heavy box falling on the toe. The distal phalanx was badly damaged, as shown in the skiagram.

THE FREE TRANSPLANTATION OF FASCIA LATA

IN THE REPAIR OF VENTRAL AND INGUINAL HERNIÆ WITH CASES *

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THE free transplantation of tissue from one part of the body to another part of the body for service is an accomplished fact and for some kinds of tissue it is so uniformly successful that a new chapter is being written into the surgery of our time. The success of the transplant does not depend so much on the complexity or the simplicity of the tissues which are transferred to new situations as it does on their blood supply. Tissues with an abundant blood supply are the most difficult to transplant with success, while tissues which are meagerly supplied with blood-vessels may be transplanted with the greatest assurance of success. Their demand for nourishment in their new home is more easily met by the lymph which oozes about them and into them, until new vessels and new connective tissue can grow to them and make them an integral part of the tissues in their new situation.

Fascia is such a tissue. It can be transplanted with almost uniform success. It is easier to transplant than bone and it is much more sure than the ordinary skin graft. In animals, I have transplanted fascia or tendons some forty-four times and have lost the transplant in only one animal, and that was due to an accidental sepsis.

It is not my purpose to report this series of experiments here. This paper is written to urge the use of transplanted fascia in the routine of practical surgical work, to add strength and to supply defects in ventral and inguinal herniæ. Plastic flaps in these cases can do much, but often they can be greatly strengthened or can be replaced by a strong fascial transplant such as may easily be taken from the ilio-tibial band of the fascia lata.

The following case illustrates its successful use in a large ventral hernia.

A woman of forty-eight came into the City Hospital on the University Service, with a strangulated hernia the size of a small grape fruit, in the

* Read March 26, 1914, before the Missouri Valley Medical Society, Lincoln, Nebraska

scar of an old abdominal incision. The strangulation had been present only a few hours and was reduced under gentle taxis without much difficulty. The symptoms subsided rapidly and she was watched carefully during the succeeding hours. As nothing developed she was allowed to remain in bed a few days to gain her physiological balance before an attempt to close the hernia was made. During the previous four years she had been operated upon three times, twice for abdominal lesions she did not understand and the third time for an unsuccessful closure of the rupture. Her scar reached from an inch and a half below the typhoid cartilage to about two inches above the symphysis, and the umbilicus had been removed. The inverted skin allowed a fist to be thrust through the hernial opening and the tissue was thin just above and below this opening.

At operation the main opening was found in the median line about four and a half inches long and three and a half inches wide with two small secondary herniæ, one above and one below the main one (Fig 1). These two smaller ruptures were easily closed by the method which has been found the most satisfactory in cases of umbilical herniæ—that is, by an upper and a lower flap so managed that one flap of tough fibrous tissue is drawn under the other by mattress sutures and the other is made to overlap it like an apron, with a suture line along its margin.

When it came to the larger hernia, it was easily to be seen that it would be impossible to close the opening between the recti muscles by direct suture. The opening was so wide and the tension would be so great that any sutures would soon cut through. A plastic operation was at once undertaken. The rectus sheaths were intact and the anterior layer ran smoothly around the muscle edge to join the posterior layer. This fact was utilized to turn a flap across the wide opening the full length of the hernia and to suture it along the edge of the rectus of the opposite side. This flap was cut the entire width of the rectus sheath and at one place included a portion of the external oblique also. A return flap was cut in the other rectus sheath and turned across and sutured into place, making a double thickness of rectus sheath to stop the opening. At the time this was thought to be sufficient. The skin was sutured and the patient returned to bed.

After the union had gone on to a good healing and we were about to let the patient go home, the hernial site still seemed a little thin to me and she accepted my proposal to strengthen it still further by a transplantation from the fascia lata. After dissecting back the skin and superficial fascia, the repair seemed much firmer than it had when examined from the outside but a strong transplant would certainly improve it. A seven-inch incision was made in the outer aspect of the thigh and two strips of the strong iliotibial band were taken, beginning just below the insertion of the vagina tensor femoris, where the fascia is strongest, three inches long and a little over two inches wide, one below the other. These were sutured side by side, transversely across the previous repair with the idea that the lines of force would act in the direction of their fibres by the natural pull of abdominal muscles under use when they had finally healed into place (Fig 2). For we have found as the result of numerous experiments on animals, as others have found, that unless transplanted fascia

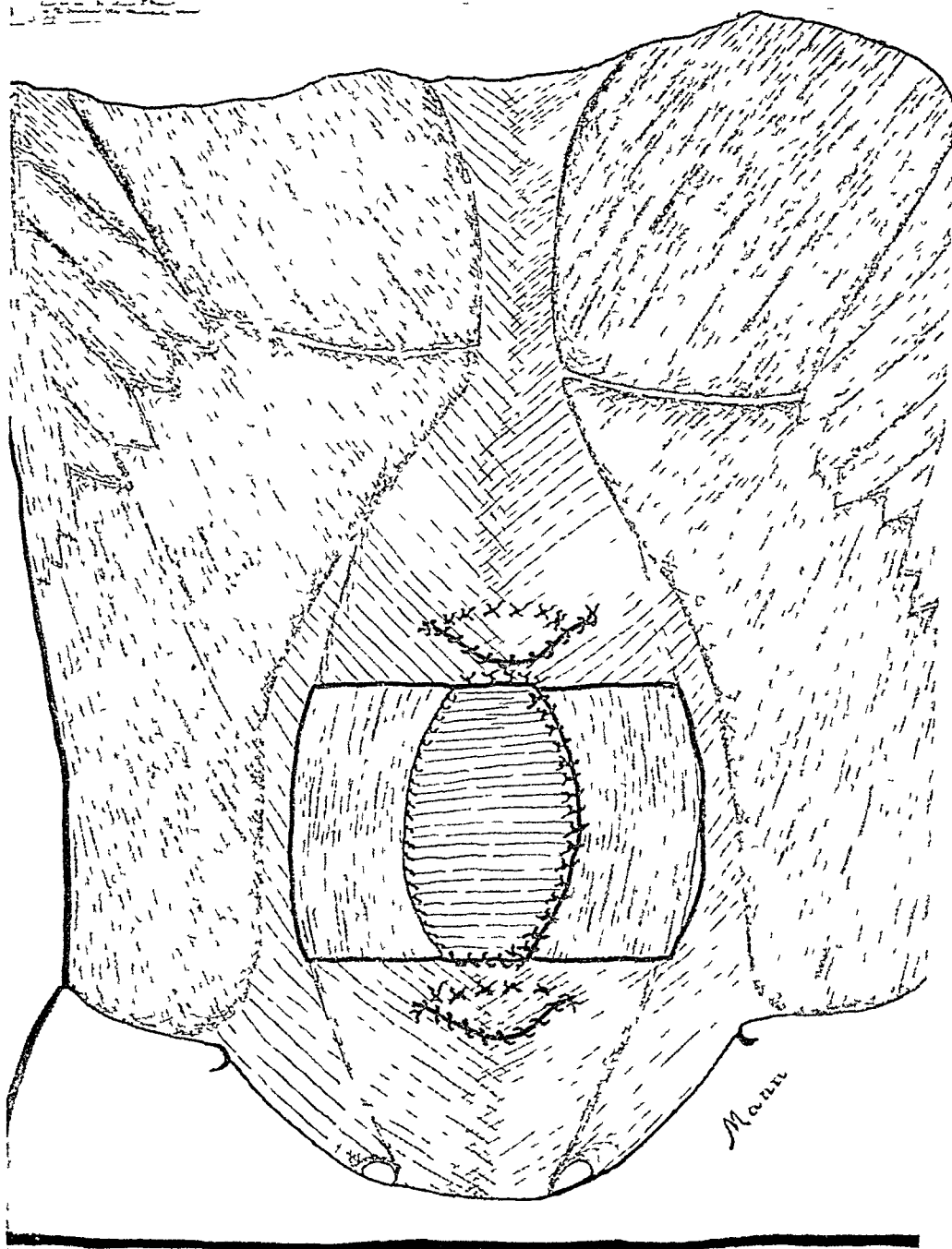


FIG 1 —Repair of large ventral hernia by turning over first the flap of the external sheath of one rectus and then that of the other across the opening. The two small ones each repaired by drawing one flap of strong fibrous tissue up under the other which was brought down over it like an apron, with a suture along its edge as in the usual peri-umbilical hernia.

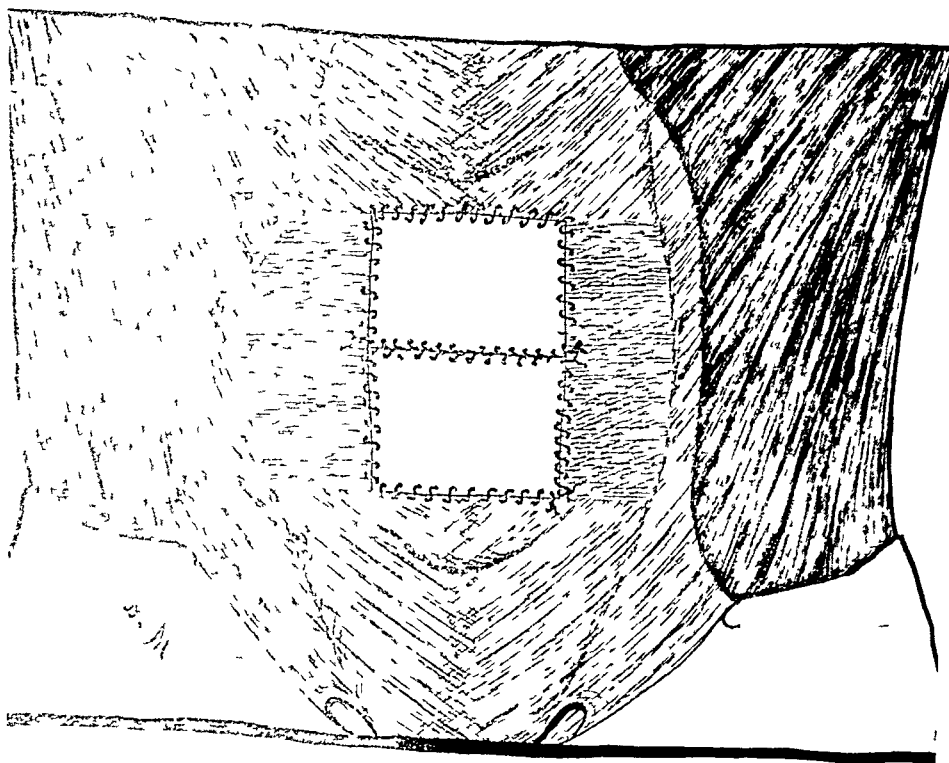


FIG 2—The two free transplants of the iliotibial band of the fascia lata sutured transversely across the repair shown in Fig 1

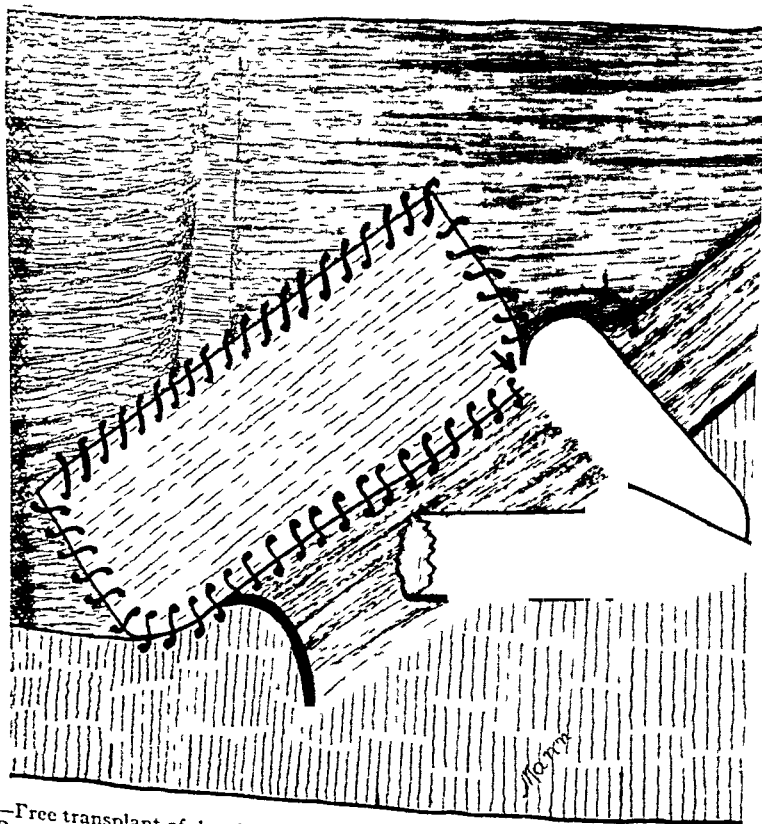


FIG 3—Free transplant of iliotibial band of fascia lata inserted above the first line of sutures in a modified Bassini operation for the repair of an inguinal hernia with weak tissues. This is sutured simply across the lower margin of the repair of the internal ring then along Poupart's ligament and well on to the sheath of the rectus and lies over the rectus sheath, the conjoint tendon and the internal oblique. The upper flap of the external oblique and the lower portion of the cord are omitted from the drawing for the sake of clearness.

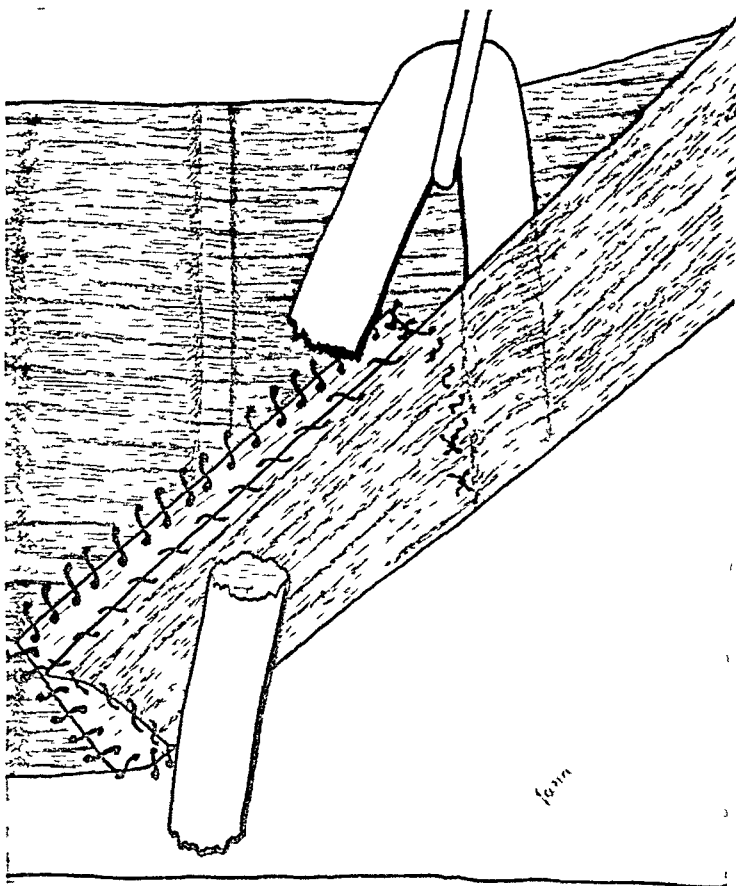


FIG 4 —Shows the lower flap of the external oblique sutured beneath the cord to add one more layer for the strength of the repair. It is drawn well over on to the rectus sheath to protect the second commonest point of recurrence opposite the external ring and sutured carefully across the lower margin of the internal ring to protect this place again which is the greatest place of recurrence.

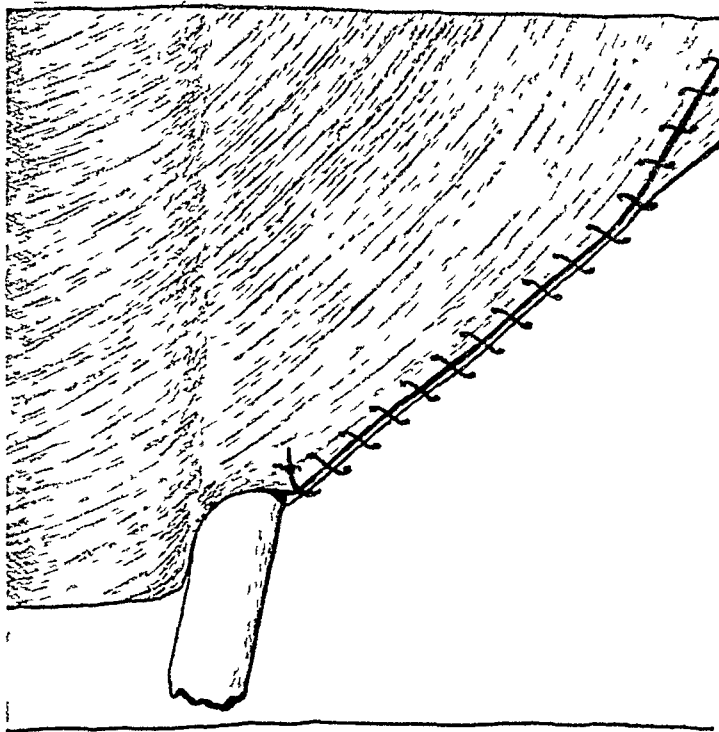


FIG 5 —Shows the upper flap of the external oblique sutured over the cord to Poupart's ligament to make a new canal for the cord.

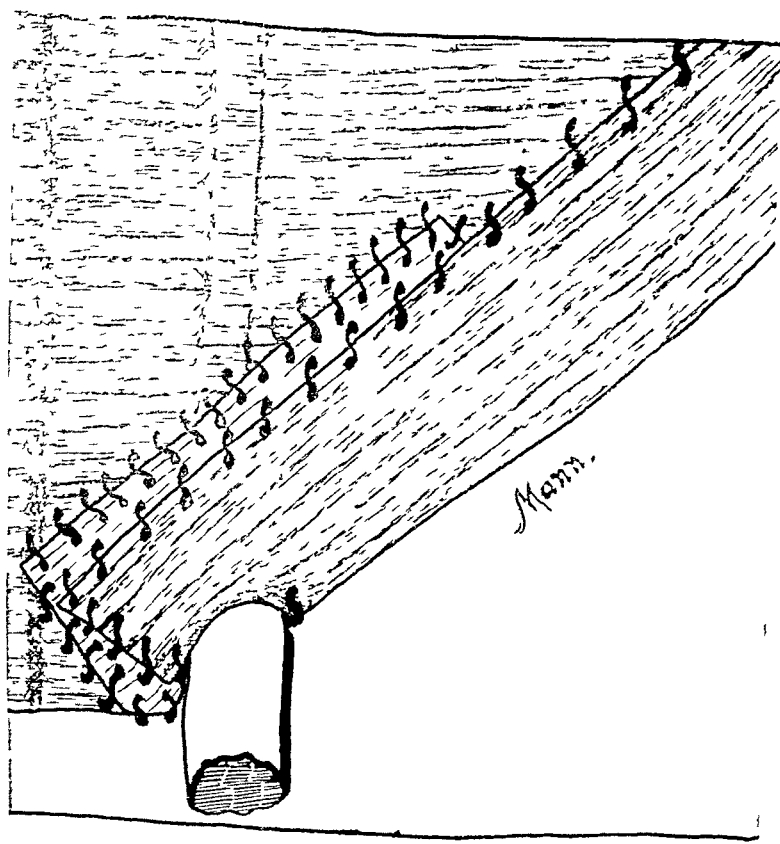


FIG 6—Shows the fascial transplant adapted to the Ferguson operation. It is inserted over the internal oblique and the conjoined tendon and well on to the rectus sheath beneath the lower flap of the external oblique. Great care is taken to suture both of them about the emerging cord. This is also true of the upper flap of the external oblique which is not here shown, but which is sutured as in Fig 5.

FREE TRANSPLANTATION OF FASCIA LATA

or transplanted tendons are kept on the stretch they shorten and become more or less replaced by ordinary connective tissue, but that when they are so fastened they preserve their structure and can sustain the strong pulls for which they are made. These transplants healed firmly into place and gave us a strong closure of our abdominal wall. The wound in the thigh healed by first intention with no loss of function in the leg and without any bulging of the muscles at rest or in use.

The use of fascial transplants in the repair of inguinal herniæ with thin or defective tissues is a little more complicated because it must fit in with the technic of the operation, but these transplants heal into place readily and firmly. I feel that the method is of distinct advantage in gaining strong closures in some of our most difficult cases.

The following case illustrates the method I have used in adapting the transplant to the Bassini operation. A male patient, on the University Service of the City Hospital, had both a right inguinal and a right femoral hernia. Both ruptures were repaired through the same incision, the femoral hernia by suture of the pectineal fascia to the lower surface of Poupart's ligament in the usual way, in the inguinal hernia the arcuate fibres of the external ring were cut well toward the top of the ring and the aponeurosis of the external oblique was separated from this point in the direction of its fibres well out beyond the level of the internal ring, making a lower flap a little less than an inch in width. The sac was dissected, opened and ligated, and the cord raised in the usual way. The conjoined tendon and the internal oblique and transversalis muscles which run into it were all thin and gave promise of a poor result. The transversalis fascia and the cremaster were both thin and did not offer much additional support. The thin outer edge of the internal ring was gently rooted outward with the finger, until the first thin fibres gave way and the thick mass of muscle fibres arching across from Poupart's ligament just above it gave a firm upper edge for the new ring. A supporting stitch, as suggested by Coley, was inserted in this muscle just above the ring to draw it to Poupart's and another close below the cord to make a snug ring, after the cremaster had been drawn upward beneath the muscles and the conjoined tendon by mattress sutures after the method of Halsted.

The muscles and conjoined tendon were carefully sutured to Poupart's, as in the Bassini operation, but they were fastened to the lower part of the shelving portion of the ligament and the sutures were passed through the ligament so that the knots would lie on the outer aspect toward the thigh and not interfere in any way with the healing of the fascial transplant which was now removed, an inch and a quarter wide, from the iliotibial band in the outer aspect of the thigh and sutured (Fig 3) along its lower border to the upper surface of the shelving portion of Poupart's ligament, with its outer end snugly up against the internal ring and its inner end reaching well on to the surface of the rectus sheath to near the midline of the body. The outer end was sutured snugly across the lower margin of the internal ring and upward to its top corner to

add material strength to the ring. The top border was sutured to the surface of the internal oblique and inward on to the rectus sheath and the inner end smoothly to the rectus sheath. In this way the two points of greatest recurrence, the one at the internal ring and the other opposite the external ring, were greatly strengthened as well as the entire suture line between.

The cord was now held upward and the lower flap of the external oblique aponeurosis (Fig 4) was sutured snugly across the lower margin of the internal ring and upward to its top border, again strengthening this ring. The inner end of this flap, which was originally the margin of the external ring, was drawn inward well on to the rectus sheath and sutured smoothly into place, in this way strengthening the inner point of greatest recurrence as well as the entire suture line by an additional layer of strong tissue. The upper border of this flap was now sutured to the parts below, completing the suture of all the tissues which were to lie below the cord. The cord was now dropped into place and the lower edge of the upper flap of the aponeurosis of the external oblique, which had been somewhat loosened from the internal oblique, was now brought down over the cord and sutured to Poupart's to form a canal for the cord (Fig 5). The inner end of the suture line was stopped at a point which would leave an easy opening for an external ring and the operation was completed by suture of the skin incision.

This patient healed by first intention throughout and when he was in condition to be up and about, the site of the inguinal repair felt firm, the tissues seemed thicker and more resistant than after the usual Bassini operation.

I have operated on two other inguinal herniæ by this method in a patient who had a double rupture, one of which, at least, he had carried for over forty years. In his case the conjoined tendons and the muscles near them were so thin that there were spaces in them which were practically holes.

In adapting the transplant to the Ferguson operation for the radical cure of an inguinal hernia where the cord is dropped back and the internal oblique and transversalis muscles, together with the conjoined tendon, are sutured to Poupart's over the cord, the technic is more simple. The fascial transplant in this case can be sutured over the first layer of tissues, taking care to suture the inner end carefully about the emerging cord, and then over on to the sheath of the rectus (Figs 5 and 6).

In conclusion I simply wish to say that the fact that transplanted fascia held on the stretch heals into place and preserves its structure and its strength in its new situation, has been abundantly proven, as well as the fact that we may probably count on a living transplant in every case of ordinary surgical first intention.

A CRITICAL ANALYSIS OF THE TREATMENT OF FRACTURE OF THE NECK OF THE FEMUR *

BY ROYAL WHITMAN, M D.
OF NEW YORK

IT is now nearly twenty-four years since I became interested in fracture of the neck of the femur through the identification of the then unrecognized cases in early life

As these fractures were usually incomplete, the immediate results were most satisfactory. Further observation showed, however, that the deformity, since known as traumatic Coxa Vara, always entailed disability. This demonstration of the dependence of function upon form and of the futility of conventional treatment, eventually suggested the abduction method, by which natural leverage, ligamentous tension, and muscular relaxation are utilized to correct deformity and to appose the fragments. The opportunity for functional recovery thus assured is supplemented by adequate support, and by protection during the prolonged period of repair.

The new method has had the great advantage that technical efficiency was the only consideration in the class of patients to whom it was originally applied, and that from this standpoint it has been adapted to cases of the ordinary type. Thus, by a process of natural evolution the application of surgical principles has been made practicable as a basic routine of treatment.

In every particular the abduction treatment is at odds with accepted principles and practice. It is taught, for example, that technical efficiency is usually impracticable because of the condition of the patient; or impossible because of the situation and character of the injury, or useless, because deficiency of circulation or spontaneous absorption or the presence of synovial fluid will prevent repair, and it is a surgical axiom that the deformity of the so-called impaction shall not be disturbed.

The consequences of a disabling injury are, economically at least, far more important to the young and vigorous than to the feeble and the aged. Yet the latter class has always received the first consideration and has determined the treatment for all. The chief concern is that it shall do harm, either by prolonged restraint or by disturbing the contact assured by so-called impaction. It is applied temporarily to

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add material strength to the ring. The top border was sutured to the surface of the internal oblique and inward on to the rectus sheath and the inner end smoothly to the rectus sheath. In this way the two points of greatest recurrence, the one at the internal ring and the other opposite the external ring, were greatly strengthened as well as the entire suture line between.

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its fellow, the operator meanwhile supporting the joint and lifting the thigh upward. The pelvis should now be level and the extended limbs in exact correspondence in every particular. A plaster spica is then applied from the axilla to the toes. This should be carefully adjusted about the pelvis and trochanter. It should completely cover the buttock and be heavily reinforced beneath the joint and thigh, that it may be unyielding to pressure and therefore effective as a posterior splint to hold the limb at its proper plane.

The complete reduction of the shortening is the basis of the method, and it is therefore essential to its success. The reason for correcting or even slightly over-correcting the outward rotation is self evident. The limb is lifted because it is often below its proper relation to the trunk.¹ The reason for complete abduction is that in this attitude the surface of the outer fragment is turned to meet that of the inner fragment, and as the capsule becomes tense, it directs them toward one another and finally forces them into contact. The tense capsule is in itself an antero-posterior splint, while upward displacement is prevented by the engagement of the outer fragment beneath the acetabular rim, if the fracture is near the head, or by direct contact of the trochanter with the side of the pelvis, if it be at the base.

The attitude of abduction prevents also displacement by muscular action since the pelvi-trochanteric group is relaxed, while contraction of the iliopsoas and adductor muscles would tend to appose, rather than to separate the fragments.

It may be noted that the plaster spica is a supplemental rather than a direct splint, its purpose being to assure the attitude rather than to fix the fragments by direct pressure. If, therefore, it holds the limb in complete abduction and complete extension and if it is unyielding beneath the joint, there is no danger of displacement even if atrophy loosens the support. If the spica is properly adjusted about the pelvis, it is quite unnecessary to include the other thigh, although this may be indicated if the less effective short spica is employed.

Incomplete Fractures—The deformity in nearly all the incomplete fractures may be easily corrected in the manner described, aided by gentle downward pressure on the trochanter. There is a type of incomplete fracture, however, in which the neck is depressed by the opening of a wedge-shaped interval in its upper border and in which the de-

¹ If the fracture is complete there is a strong tendency for the femur which lies on a higher plane than the trunk to sink backward. This is perhaps the chief reason for failure when conventional treatment is employed. The Maxwell method of anterolateral traction serves indirectly as a splint to prevent this and it is therefore the most efficient of all the traction methods.

relieve pain or to protect deformity, and for longer periods to appose and fix the separated fragments. The essential basis of the methods employed is traction in the line of the body. This is so inadequate for its purpose that it could be made effective, if at all, only by careful adjustment and constant supervision. Under ordinary circumstances, therefore, the attainment of its object is usually a matter of chance.

The results correspond to the character of the treatment. According to the latest statistics, those of the British Committee, in but 22 per cent of the cases could they be classed as good, even from the weight-bearing standard.

Dismissing for the sake of argument, preconception and prejudice, it will be admitted, that in a large proportion of the cases, some treatment is applied with the design of promoting the repair of the local injury, however remote the prospect may be.

It has been amply demonstrated in recent years that repair is possible in every variety of this fracture. On the other hand, it is evident that union is impossible unless the fragments are in contact, however adequate the blood supply and however great the resistance to spontaneous absorption. The object of treatment, therefore, is to provide the opportunity for repair, since otherwise failure is inevitable.

The abduction treatment is the only method that enforces this principle and the only method by which the principle can be made effective in a comprehensive sense. It was presented to this society in 1902, but it still remains a novelty, in all but name at least, if the misconceptions of the text-books may be accepted as a criterion.

For this reason a description of the method is an almost essential preliminary to intelligent discussion, which must of necessity involve the foundations of accepted teaching.

This description may begin with the complete fracture, since this is the only form in which direct comparison with other methods is possible.

The patient, usually anæsthetized, is lifted to a pelvic support, preferably furnished with a perineal bar for counter pressure, the extended limbs being supported by assistants. The assistant holding the uninjured limb abducts it to the normal limit in order that it may serve as a guide, and incidentally to fix the pelvis. The injured limb is first flexed and rotated sufficiently to disengage soft parts that may be interposed between the fragments. It is then completely extended, and the assistant, by direct manual traction, overcomes the shortening, as demonstrated by measurement and by the relation of the trochanter to Nelaton's line, at the same time correcting the outward rotation. Still maintaining steady traction, he then abducts the limb to correspond with

TREATMENT OF FRACTURE OF NECK OF FEMUR

its fellow, the operator meanwhile supporting the joint and lifting the thigh upward. The pelvis should now be level and the extended limbs in exact correspondence in every particular. A plaster spica is then applied from the axilla to the toes. This should be carefully adjusted about the pelvis and trochanter. It should completely cover the buttock and be heavily reinforced beneath the joint and thigh, that it may be unyielding to pressure and therefore effective as a posterior splint to hold the limb at its proper plane.

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formity is somewhat resistant. In such case correction is accomplished by traction and abduction, utilizing what has been called natural leverage to overcome the resistance. The explanation is as follows:

The range of normal abduction is checked by contact of the upper border of the neck of the femur with the rim of the acetabulum when in its descent it has reached an approximately horizontal plane. If, therefore, it is depressed to a right angle (*Coxa Vara*) contact is established and abduction is checked while the limb is in the line of the body. This contact fixes the neck and one may restore the normal angle by placing the shaft in proper relation to a horizontal neck, namely, in full abduction, thus bringing the fractured surfaces into contact. The limb is then fixed by the spica in the manner already described.

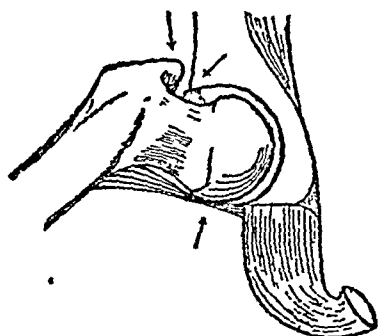


FIG 1—The range of normal abduction depends upon the angle of the neck of the femur. It is limited by tension on the capsule by contact of the upper border of the neck with the acetabulum and of the trochanter with the side of the pelvis.

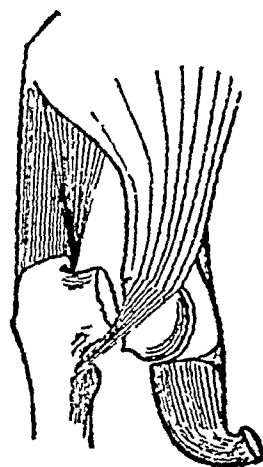


FIG 2—The characteristic displacement of complete fracture is of the femoral fragment laterally and backward by the influence of gravity and upward by muscular tension.

Deformity, however slight, should be corrected as the essential preliminary of restored function, and far from endangering repair, it is the best means of hastening it by apposing the cancellous surfaces upon which the union in fracture of the small part of the neck depends.

As the abduction method is based on the anatomical construction of the joint, its typical application implies the restoration of an approximately normal contour, as is possible in the great majority of fractures caused by indirect violence. If, however, the bone were crushed or telescoped, or if the neck were otherwise shortened, thus limiting abduction, the method, like any other definite surgical procedure, must be modified in adaptation to the changed conditions.

In a treatment designed to restore function, as distinct from the capacity to support weight, the protection of the weakened part during

TREATMENT OF FRACTURE OF NECK OF FEMUR

the period of repair and reconstruction is almost as important as the preliminary reduction of deformity. No direct pressure should be permitted for many months nor until voluntary control has been regained and until passive movements are relatively free and painless. This calls attention to another advantage of the treatment, since the fixation of the limb in abduction assures freedom of movement in that direction, in place of the restriction that is invariably present even in the most successful cases treated in the ordinary manner.

Under the present system early weight bearing is not only permitted but encouraged on the ground that repair will either be hastened or that the patient will the sooner become accustomed to a disability that is regarded as, in most instances, inevitable.

The most constant misconception of the abduction treatment is that its application requires force or even violence and that it is a dangerous treatment as compared with conventional methods which are supposed to be peculiarly adapted to physical weakness.

Normal abduction is often described as forced abduction, when, practically speaking, no force whatever is required except in the reduction of epiphyseal displacements, a type not now under consideration.

The plaster spica also, which in the absence of especially constructed apparatus is the only splint at command, is thought to be a relatively uncomfortable and dangerous form of restraint. Consequently some of those who appreciate the technical superiority of the method would restrict it to the treatment of youthful subjects.

On the contrary, as compared to other methods, the abduction treatment is not only efficient in the technical sense, but it has a far wider range of application. The plaster spica being an independent splint and free from attachments, permits any desired change of posture. And the head of the bed may be elevated to any degree to lessen the danger of internal congestion and to increase the blood supply of the injured bone.

Thus, pain on movement, the most dangerous and depressing form of restraint, bedsores, the most constant accompaniment of enforced rest upon the back, and hypostatic congestion, still further favored by elevation of the foot of the bed, as is usual when traction is employed, are practically eliminated as complications.

I do not propose to befog the issue of efficient technical treatment by considering cases of what may be termed the inoperable class. It may be of interest to note, however, that an interval of eighty-five years separates the youngest from the oldest patient to whom this treatment has been successfully applied.

I trust that this exposition has justified the statement that the essen-

tial distinction of the abduction method is that obstacles have been transformed to aids in that it utilizes the construction of the joint to apply surgical principles

It is therefore the only safe and practicable means of correcting deformity of the incomplete or so-called impacted type. It is far more efficient in assuring coaptation of separated fragments than any other method, even if applied under the most favorable conditions, since, assuming that the primary adjustment is satisfactory, its maintenance is dependent upon the quality of the nursing. Finally, adequate protection during the period of reconstruction is enforced as an integral part of the treatment.

However efficient the method, it is evident that skill, and experience in the selection of cases, and in modifying and adapting it to the con-

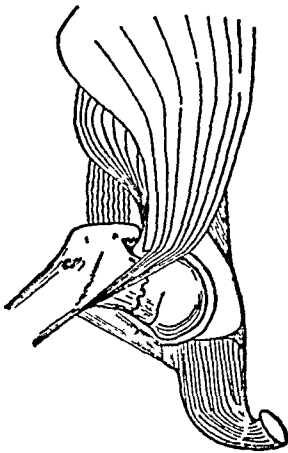


FIG 3—Illustrating adjustment of the fragments by abduction. Security is assured by ligamentous tension and direct contact and by the elimination of the deforming influence of muscular contraction.

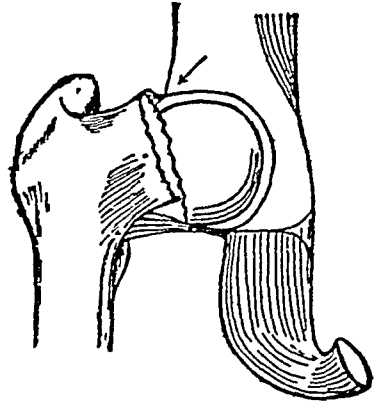


FIG 4—A type of so called impaction in which the femoral fragment is displaced upward and outward thus checking abduction. This deformity may be easily corrected by the abduction method without the slightest danger.

dition of the patient and to the character of the injury, are requisite for the best results. Furthermore, as a firm and comfortable splint to supplement the correction of deformity is even more essential in the treatment of this than of other fractures, a certain familiarity with plaster technic is desirable.

The abduction treatment demands, therefore, more initial energy and a higher standard of technical skill than are usually at the command of this neglected injury. On the other hand, since a new treatment must of necessity be applied by novices, it has the great advantage that its purpose is clear and definite, that its effects are capable of demonstration and that from the beginning to the end it is controlled by the one who is responsible for the result.

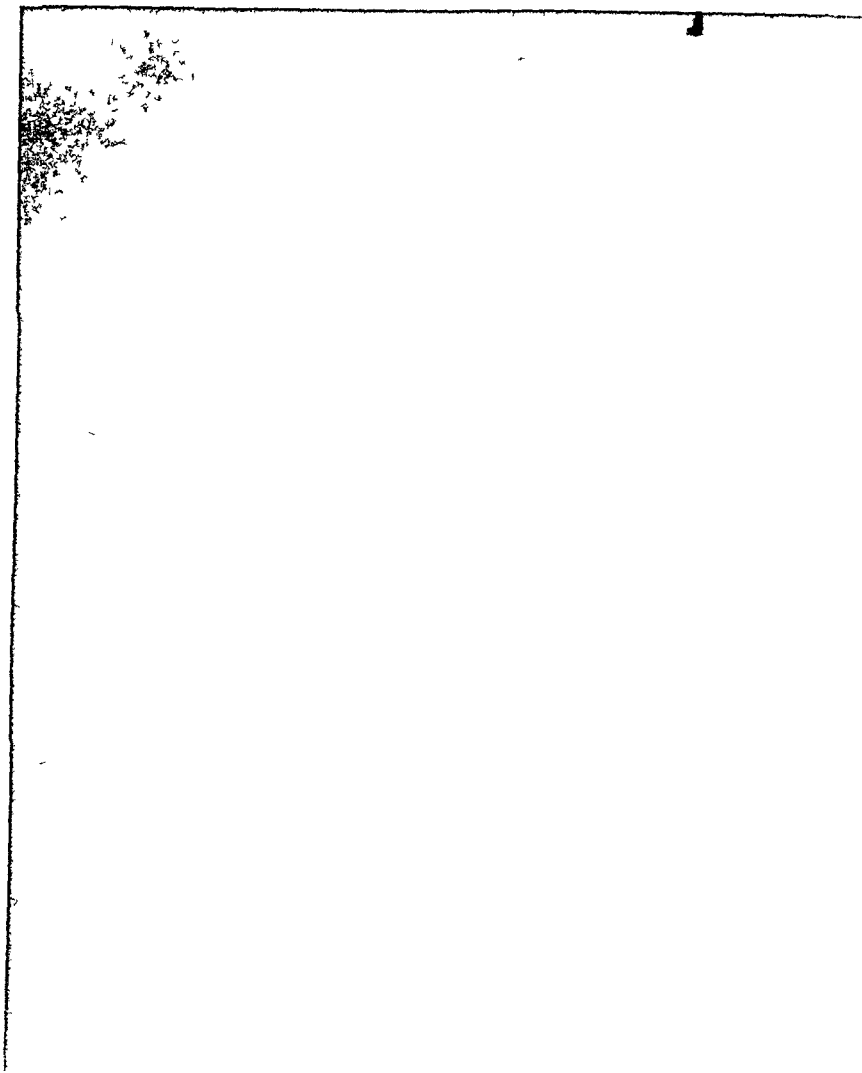


FIG 6 —Illustrating an anatomical cure of a complete intracapsular fracture in a woman 65 years of age treated by the abduction method The projection on the upper border of the neck indicates the line of fracture

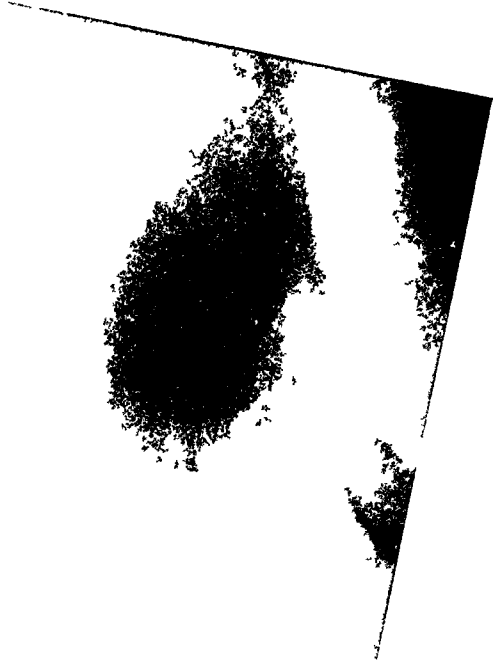


FIG 7—A series of pictures illustrating slow repair in fracture of the small part of the neck. The patient is a man thirty one years of age fractured the hip while playing tennis. He continued to walk about with canes for nearly six weeks

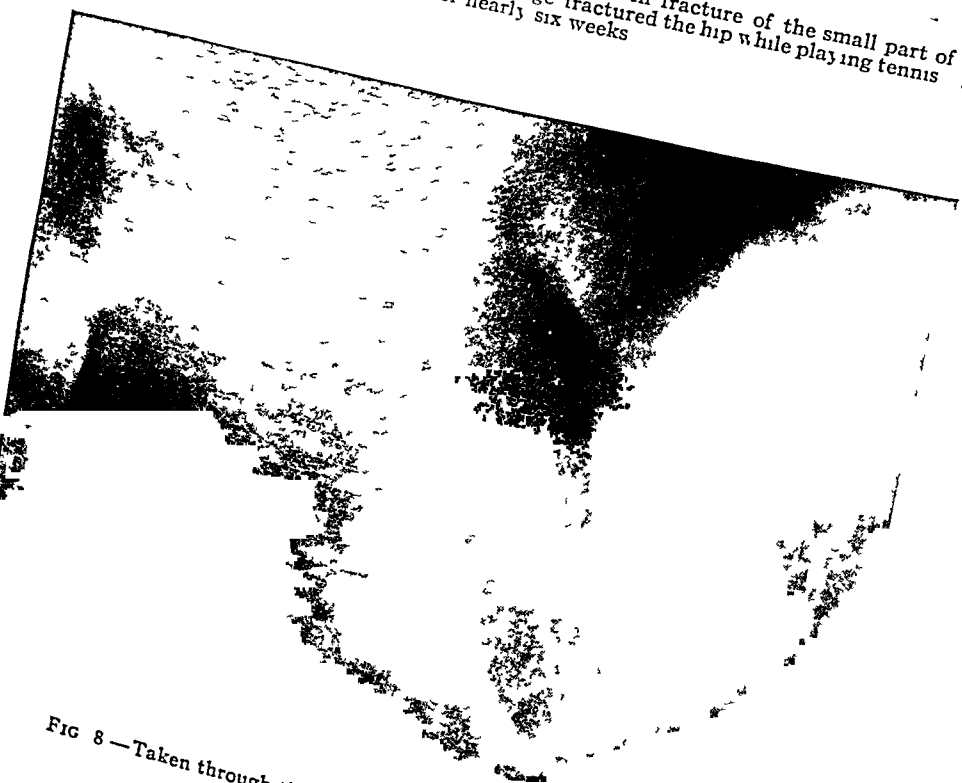


FIG 8—Taken through the plaster after reduction of the deformity

FIG 9 —Six months later showing slow repair. The separation of the fragments indicates that the degree of adhesion at the time of the operation was not sufficient to force contact, or that the union was not strong enough at the end of three months, when the spica was removed, to prevent a slight recurrence (Reversed)

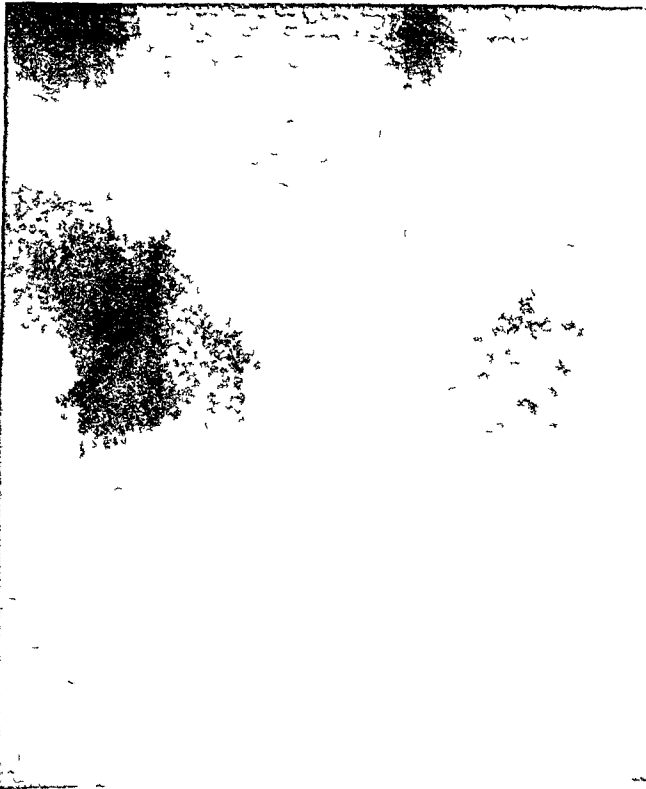


FIG 10 —Two years after the accident showing almost complete repair. As compared with Fig 9, the lessened angle may be noted although the injured bone was protected by the use of a hip splint for more than a year. These pictures demonstrate several important points: 1. That the neck of the femur in a vigorous person may be broken by what appears to be slight violence. 2. That a fracture may not cause complete disability. 3. That in this instance the deformity could not have been reduced by conventional treatment and that efficient protection was essential to success.



FIG 11 —The elevation of the head of the bed (25°) to provide a semi-reclining posture and thus to lessen the danger of thoracic congestion and to improve the nutrition of the injured part

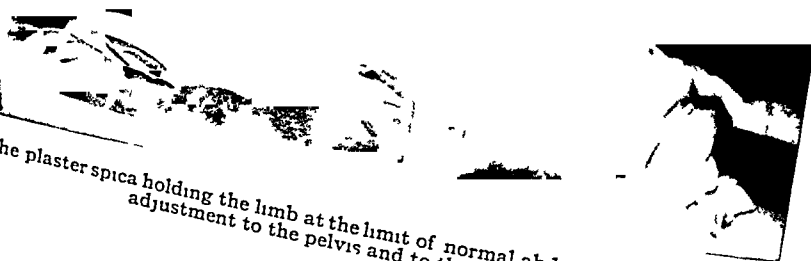


FIG 12 —The plaster spica holding the limb at the limit of normal abduction illustrating the adjustment to the pelvis and to the hip

TREATMENT OF FRACTURE OF NECK OF FEMUR

The question of prognosis, particularly as it is influenced by treatment, is necessarily limited to the class of cases in which treatment is applied, the class for example that has furnished the statistics already referred to

The causes of failure as presented in the text-books are

- 1 Low vitality and thus incapacity for repair
- 2 Crushing of the bone by direct violence
- 3 The impossibility of assuring apposition and fixation of the fragments
- 4 Spontaneous absorption
- 5 The presence of synovial fluid

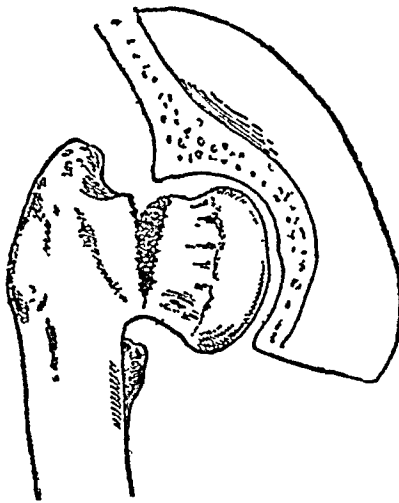


FIG 5 —Another type of incomplete fracture which may be corrected by natural leverage

Of these the first is the most important, and the most reasonable. But if the fracture is to be treated at all, it is also the most forcible argument for accurate and secure adjustment of the fractured surfaces in order to assure, at least the possibility of union. Assuming that the capacity of repair is normal in childhood and that it diminishes with advancing years, the results should correspond fairly with the age of the patient.

This is not apparent in the statistics that have been quoted. Twenty of the patients were between twenty-four and forty-five years of age with six good results. Thirty were between forty-five and sixty, with eight good results, and thirty-six were more than sixty, with five good results. I may add a personal observation of five cases of non-union in early life, in patients treated by conventional methods.

Crushing of the bone by extreme violence must be unusual and as this would prevent success in the treatment of any fracture, it needs no further consideration.

That the apposition of separated fragments by the means hitherto available is doubtful and that this is a valid reason for not correcting deformity, needs no discussion, since it is the purpose of this paper to prove it

Absorption in other situations is considered a consequence of non-union, of atrophy and friction of the fragments. Such natural absorption should be relatively rapid at the hip because of the small proportion of resistant bone in the femoral neck

"Spontaneous" absorption, it may be assumed, is a mysterious process that must prevent repair under any conditions. Neither natural nor spontaneous absorption occurs in cases successfully treated and the best prevention must be, therefore, efficient treatment

The same reasoning applies to the synovial fluid which is present in all joint fractures and whose influence on repair is problematical

The prognosis based on anticipated failure is the most scientific and the most helpful element of conventional teaching. It is scientific because it is supported by actual results, whatever the interpretation put upon them. It is helpful because the exponent of efficiency has much to gain and nothing to lose by comparison

It would seem that the methods hitherto at command have been technically inadequate, that this inadequacy has established the principles of treatment, that defective principles and inadequate methods have led to carelessness and neglect, and that the combination accounts for the results. The results in turn have been accepted as evidence of the incapacity of the tissues for repair, thus completing the vicious circle that explains the general lack of interest in the most disabling of all fractures

The aim in treatment should be anatomical and functional cure, since this offers the only possibility of complete success and the best assurance against complete failure

However radical this proposition may seem, it is the principle on which every other fracture is treated, a principle to which the abduction treatment conforms and by which alone, in a comprehensive sense, it may be applied. It would seem, therefore that it must eventually displace methods that have been so thoroughly discredited by practical experience and as a natural consequence the superstructure of traditional teaching that excuses the quality of treatment that these unfortunate patients receive

FLASHLIGHT AUTOCHROM PHOTOGRAPHY OF PATHOLOGICAL SUBJECTS

BY HARRY H. HART

OF BALTIMORE, MD

RONTGENOLOGIST AND PATHOLOGICAL PHOTOGRAPHER TO THE HOWARD A. KELLY HOSPITAL

THE use of autochroms in the study of diseases is not new. Monsieur F. Monpillard, in a paper read before the French Photographic Society and published in the *British Journal of Photography* of May, 1911, gives Dr. Morax, of the Lariboisière Hospital, credit for first establishing a regular installation for autochrom photography of pathological subjects by flashlight. Such an installation may be added at small expense to the equipment of almost any hospital, and its advantages are obvious.

The speed of the flashlight (about one twenty-fifth of a second) makes it possible to secure pictures of children and nervous patients, who could not keep still long enough to be photographed by the slow daylight method. By making the autochroms lantern-slide size, we obtain permanent and absolutely true records of lesions with characteristic coloring, and in a form which enables us to demonstrate them to students at any future time. In our collection we have pictures of epitheliomata of the eye, nose, mouth, ear, chin and cheek, sarcomata of the forehead, parotid (melanotic), and shoulder, and several varieties of breast cancer. Lesions of the skin with pale delicate colors are not so successful, as the grain of the plate interferes somewhat with the definition. The autochroms give satisfactory results when projected in a stereopticon, provided the image is not magnified too many diameters, and a fairly strong arc light is used in conjunction with a perfectly white opaque screen.

Many hospitals are now provided with some facilities for making photographic records of cases, and anyone with a working knowledge of photography can soon learn the few additional points necessary to make autochroms. The Lumière Company distributes free of charge a little instruction book embodying all the essential features of the process. We have recently adopted a special cabinet for the ignition of the flash powder which possesses a number of advantages over the open flash lamp heretofore used for autochroms (Fig. 1). These advantages consist in

1 Safety The interior of the cabinet is lined with sheet asbestos (painted dead white), and the diffusing screen covering the front is fire-proof This overcomes the greatest objection to the use of flashlights in hospitals, where a fire among patients unable to look after their own safety is apt to have very serious consequences

2 The large reflecting surfaces add enormously to the power of the illumination, so that we can secure full exposures by the use of half the quantity of powder recommended by the Lumière Company for the open flashlight lamp

3 The diffusing screen serves to spread the light and to give finer detail and roundness to the image

The general plans for this cabinet were kindly furnished by Mr Otto Doehn, of the Eastman Kodak Company, who has used a similar one for flashlights on ordinary photographic plates We found it necessary to make several changes in his original designs, in order safely and efficiently to handle the heavy charge of powder necessary to secure sufficient exposure of autochroms, which are much slower than the average plates

The cabinet proper consists of a box built of light, half-inch boards, reinforced at the joints by heavy strips of wood It is suspended by cables and pulleys to an upright frame, nine feet high and four feet two inches wide, and is thus easily adjusted to any desired height (all dimensions given are outside measurements) The ground supports at right angles to the upright frame are three and a half feet in length and are provided with castors, so that the whole apparatus can be moved about The box is five feet high, by three feet eleven inches wide, and at the top measures thirty-two inches from front to back, and at the bottom twenty inches from front to back The back is perpendicular to the bottom, and the front slopes up to an obtuse angle of about 100° to the base The box is provided with a door in front, hinged at the top and fastened by hooks at either side This door is a frame made of strips of wood two and seven-eighths inches wide, and seven-eighths of an inch thick Attached to each corner of the frame by short pieces of broad elastic is the diffusing screen, this consists of fire-proof¹ Persian lawn, bound on all four sides with strong white tape (*A, B, C, D*, Fig 1) The object in fastening the diffusing screen only at the corners by means of elastic, is to allow an outlet for the gas suddenly generated by the ignition of the powder, which would split the screen if it were fastened tightly to

¹ See the Lumière Autochrom booklet for fire-proofing formula

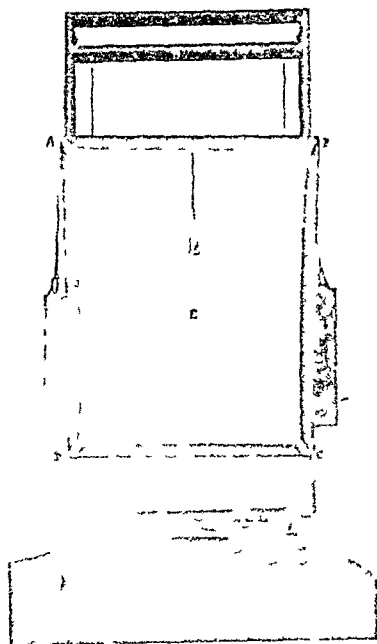


FIG 1 —Front view of the light cabinet A, B, C, D short pieces of elastic used to fasten the light-diffusing screen to its frame, E 500 candle power tungsten lamp for focussing

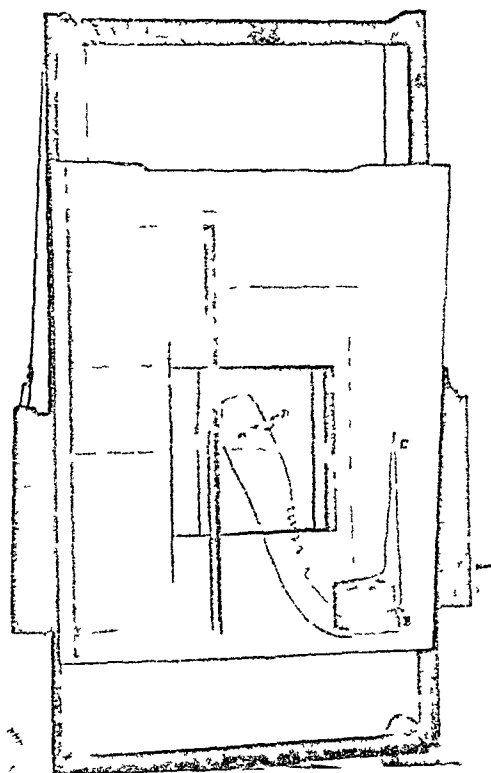


FIG 2 —Interior of cabinet front door removed A powder shelf, B spark coil, C brass strip forming upper electrical terminal, D, spark gap, E, wires running through wall of cabinet to outside switch

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FLASHLIGHT AUTOCHROM PHOTOGRAPHY

the frame. An outlet for the smoke is provided by cutting an opening in the roof of the box just behind the front door. A smoke-bag of fire-proof muslin can be arranged to fit over this opening. This bag is closed by a draw-string after the flash is over, and the smoke carried out of the building and emptied. A smaller door (two feet square) at the back of the cabinet gives access to the shelf which holds the powder.

Fig 2 shows the interior of the cabinet, the front door having been removed. The powder is spread upon the shelf *A*, which is made of asbestos board, seven inches long and three inches broad. Ignition is secured by means of a spark from a small induction coil *B*, which is excited by the six-cell battery shown just behind the coil. One electrical terminal consists of a piece of brass in the floor of the asbestos

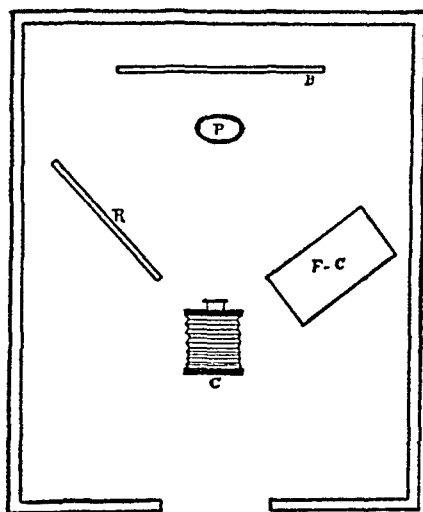


FIG 3 —Diagram showing general arrangement of flashlight studio. *C*, camera, *P*, patient, *F C*, flashlight cabinet, *B*, background, *R*, reflector

shelf and the other terminal is the brass strip *C*. These terminals should be cleaned with sand-paper after each explosion of powder. The powder does not ignite easily and it is best to pile most of it in the centre of the shelf, and lead only a small quantity in the form of a train up to the spark terminal *D*. The shelf can be raised or lowered, as it is attached by means of brass spring clips to its support, which consists of a metal curtain pole placed a little to the left of the median line of the cabinet. The powder is ignited by closing a switch outside the cabinet connected with the wires *E*, which lead from the battery and induction coil through the walls of the cabinet. This outside switch consists of a piston which closes the circuit when a bulb is pressed at the end of a long rubber tube, this enables the operator to set off the flash when he is several feet away

from the cabinet. The opposite end of the bulb could be connected with a rubber tube leading to the lens shutter, so that the lens would be opened simultaneously with the setting off of the flash. This, however, we have not found necessary, we simply remove the lens cap just before making the exposure. Focussing is done by the light of a 500 candle power tungsten bulb (*E*, Fig 1) which is moved out of the way before the powder is ignited. Daylight is eliminated from the room, as far as possible, otherwise the rendering of colors will not be accurate. The cabinet and powder shelf are adjusted so that the light is about one foot higher than the patient's head and about six or seven feet away from him. A reflector, consisting of an ordinary muslin sheet about four feet wide and six feet high, is suspended from a T-shaped support and placed about three or four feet from the patient, on the side opposite the light. Fig 3 shows the general arrangement of the apparatus. *F-C* is the flash cabinet, *P*, the patient, *R*, the reflector, *C*, the camera and *B*, the background (of colored felt).

We use in this work a Cooke lens working at $F/5.6$ and are able to secure a full exposure on a four by five plate with one hundred and fifty grains of perchloro powder. This is just half the quantity recommended by the Lumière Company when using an open flash lamp at the same lens aperture. Even less powder may be used in making autochrom lantern slides, provided a relatively small image is desired.

The whole cabinet, including spark coil and battery, can be built by any good carpenter for about thirty dollars.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY

*Stated meeting, held at the New York Academy of Medicine,
March 11, 1914*

The President, DR FREDERIC KAMMERER, in the Chair

DOUBLE PERFORATION OF THE DUODENUM

DR CHARLES L. GIBSON presented a young man who came to the New York Hospital in February, 1913, with two acute perforated ulcers of the duodenum, through which the contents of the bowel were escaping. The ulcers were closed separately by simply infolding the tissues, and while this produced a certain amount of diminution in the calibre of the gut, it did not seem sufficient to require a gastro-enterostomy, and the wound was closed.

A year had now elapsed since the operation. The patient had remained entirely free from his old symptoms, he had gained eighteen pounds in weight, and showed no evidence of stenosis or stasis. Dr Gibson said he had shown this patient shortly after the operation, and his object in presenting him again to-night was to emphasize his contention that in operations for perforated duodenal ulcers, a gastro-enterostomy was only indicated in those cases where there was a distinct narrowing of the bowel, and that such cases were comparatively rare.

DR CHARLES H. PECK said he was inclined to agree with Dr Gibson that many of these patients would make a permanent recovery after a simple closure of the duodenal ulcers, without gastro-enterostomy. On the other hand, there were a certain number where the ulcer was located near the pylorus, with a good deal of induration, and where the infolding produced a very decided narrowing of the pylorus. Under those conditions it seemed wise to do a gastro-enterostomy. The speaker said that while he was not prepared to give any figures, he did not believe as firmly now as he did some years ago that these patients could be left without a gastro-enterostomy as a matter of routine, and he thought it safer to do a gastro-enterostomy if the condition of the patient was not too critical.

DR FRANK S. MATHEWS recalled a case of duodenal ulcer which

perforated twice in one year After the first perforation operation was confined to closing the perforation. After the second a gastro-enterostomy was added to closure The speaker saw the patient later, when suffering from a subphrenic abscess

DR WILLIAM A DOWNES said that for some time he had felt that a gastro-enterostomy should be added in practically every case of perforated duodenal ulcer where the patient was equal to the procedure

In one of his very recent cases, however, where the patient was *in extremis*, he hurriedly sewed up the ulcer, feeling certain that the duodenum was being almost occluded, without doing a gastro-enterostomy, and the operation was followed by one of the best recoveries he had ever had

The President, DR KAMMERER, said we should not lose sight of the possibility of a narrowing of the lumen of the gut after infolding of a duodenal ulcer Personally, in these cases, he was always inclined to add a gastro-enterostomy whenever possible

DR CLARENCE A McWILLIAMS said that in some experiments on normal cats, where they had excised at least one-half the diameter of the duodenum and then closed the wound, it was found at autopsies made at various periods afterwards on the surviving cats that the lumen of the gut had been restored to practically its normal size It had apparently been stretched by the *vis a fronte* to the necessary extent

VON RECKLINGHAUSEN'S DISEASE

DR A V MOSCHCOWITZ presented a girl, twenty-one years old, who was admitted to the Mt Sinai Hospital on February 12, 1914 Her family history was entirely negative, as far as heredity was concerned Some years ago a small tumor, the nature of which she did not know, was removed from the right side of the neck Ten years ago she noticed a tumor the size of a walnut on the postero-internal aspect of the left arm this had gradually grown larger, particularly so during the past year Its growth was accompanied by pain and weakness, involving the entire upper extremity

Upon examination, numerous cutaneous nodules were found scattered over the entire body, varying in size from that of a millet-seed to that of an olive In addition, there were many palpable subcutaneous growths, usually of a larger size than the superficial ones The postero-internal aspect of the left arm was occupied by a mass, approximately the size of a cocoanut, which was composed of a large number of discrete tumors (Fig 1) This mass was very painful and tender,

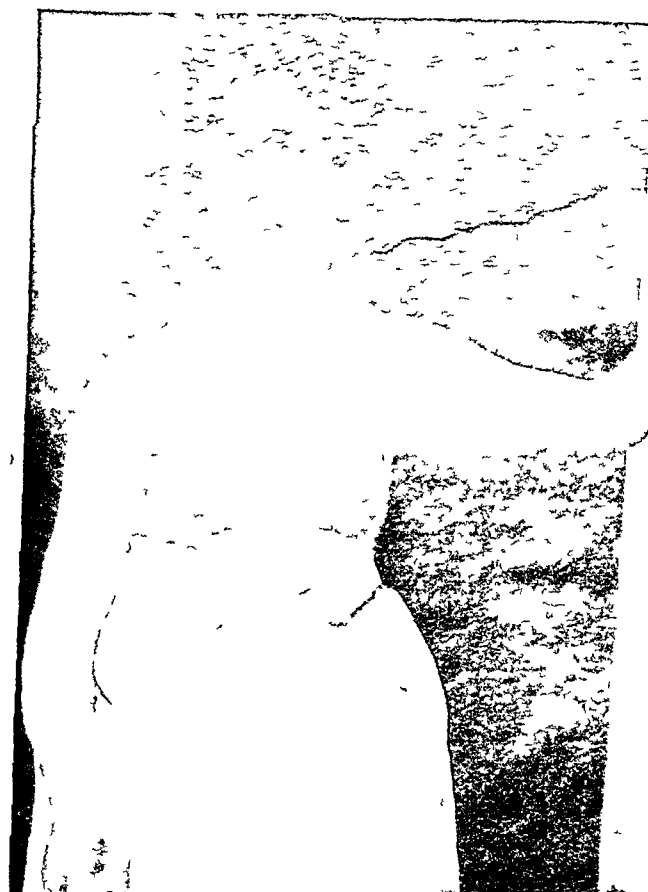


FIG 1 —Von Recklinghausen's disease

MEDIOGASTRIC RESECTION OF STOMACH

otherwise, sensation was not disturbed. Pigmented areas were scattered over the entire body, a particularly extensive one covering most of the left half of the thorax and the left arm. The patient's mentality was excellent, showing that in this instance the third symptom in the triad of this disease was lacking.

The operation, which was done on February 17, 1914, proved extremely difficult and tedious, lasting over two hours. The musculospiral nerve was recognized and was found to be enlarged to the size of the little finger, but it was not involved in the tumor mass. One other nerve, the circumflex, led into the tumor, but the greater portion of it was preserved. The dissection led down to the humerus, and anteriorly up into the axilla. No claim for radicality was made, because at the extreme limits of the incision there was still some evidence of tumor tissue, doubtless leading to other parts of the body. Primary union resulted, and the patient left the hospital eleven days later.

Upon gross examination, the extirpated mass was apparently composed of two elements. One form was globular or ovoid in shape, and was somewhat translucent, the second was composed of white, convoluted, soft masses, resembling spaghetti, and corresponding in all respects to the classical description of a so-called "plexiform neuroma." Upon microscopic examination, however, both varieties appeared to be identical.

The speaker said he was indebted to Dr. F. S. Mandlebaum for the following pathological description of the specimen:

Sections show a loosely woven, fibrous, connective tissue stroma running in all directions, individual fibres of which are often separated from each other by oedematous looking tissue. The nuclei are spindle-shaped and numerous. Small mononuclear cells are scattered throughout the section. The tumor is fairly rich in blood-vessels and capillaries, these appear to be normal. Neither the hæmatoxylin-eosin nor van Gieson stains show positive nerve fibrils, but a final opinion on this point cannot be given until the Weigert preparations are finished. The general appearance of the tissues suggests either a neurofibroma or a simple oedematous fibroma of unusual type.

MEDIOGASTRIC RESECTION OF THE STOMACH FOR ULCER, WITH HOUR-GLASS CONTRACTION

DR. WILLIAM A. DOWNES presented a woman, twenty-eight years old, who was admitted to St. Luke's Hospital on February 8, 1914, complaining chiefly of vomiting and abdominal pain. These symptoms, from which she had suffered occasionally for several years, usually

came on directly after eating About one year ago she had a severe attack, with hæmatemesis

Nine days prior to her admission to the hospital her pain became more severe, and was followed by tenderness in the epigastrium The pain was accompanied by a burning sensation The stomach was able to retain only water, there was no blood in the vomitus Physical examination showed that the patient was fairly developed, but poorly nourished There was tenderness in the epigastrium, with rigidity of the recti in the upper half An X-ray examination revealed a penetrating ulcer at the middle of the lesser curvature of the stomach, with moderate constriction, dividing the stomach into two pouches of about equal size

On February 12, 1914, Dr Downes did a mediogastric resection There was an ulcer, 3 cm in diameter, situated on the posterior wall just below the lesser curvature This had perforated and was adherent to the pancreas The stomach was contracted in the centre, forming an hour-glass constriction The pylorus was normal A segment of the stomach 3 inches wide, including the adherent portion of pancreas, was removed

With the exception of one attack of vomiting, eight hours after the operation, the patient made an uneventful recovery

The difficulties connected with the operation, the speaker said, were much less than he had imagined It took about two hours In bringing the two segments of the stomach together, he left perhaps half an inch of tissue projecting inward from the clamps The peritoneal stitch, starting at the upper angle and continued along the posterior wall, was easily placed by rotating the clamps outward

ANEURISM OF THE DEEP FEMORAL ARTERY FOLLOWING SUBTROCHANTERIC FRACTURE OF THE FEMUR

DR JAMES M HITZROT presented a man, forty-seven years old, a painter, who was admitted to the New York Hospital on December 30, 1913, with the history of having fallen from a scaffold six months previous to that date, striking on his left hip He was taken to the Knickerbocker Hospital and treated by the Steinmann extension method, and he remained there for seven weeks

On admission to the New York Hospital he said that two months ago the thigh began to swell in the region of the fracture The swelling rapidly increased in size and was accompanied by great pain in the

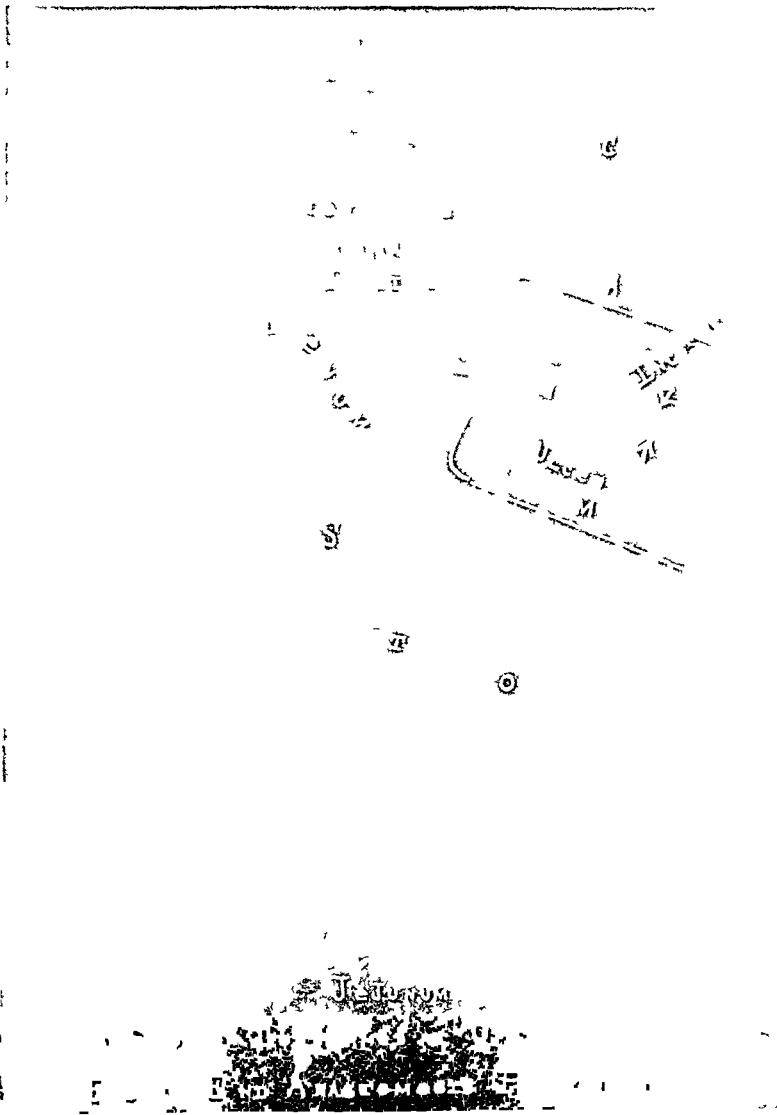


FIG 2 —Hour glass stomach, showing lines of mediogastric resection for ulcer



FIG 3 --Condition of stomach after mediogastric resect on and end-to end anastomosis

ANEURISM OF THE DEEP FEMORAL ARTERY

leg, so that he was unable to walk. Recently, he had lost considerable weight.

Examination showed a poorly nourished, rather anæmic man, with a fusiform swelling over the upper third of the thigh. This swelling was smooth and firm, and somewhat elastic, and involved the inner aspect of the thigh to about its middle. It did not pulsate and was tender on handling. The circumference of the thigh over the swelling was 55 cm. The affected leg was 3.5 cm. shorter than its fellow, and flexion at the knee was limited to about 20 degrees. The X-ray showed a subtrochanteric fracture of the femur, with abduction and flexion of the upper fragment, an angulation at the site of the fracture, and some overlapping of the bone ends, which were solidly united. In the soft parts there was a diffuse swelling which did not seem to involve the bone.

Operation, January 3, 1914. An exploratory incision was made over the anterior surface of the thigh, parallel to the inner border of the sartorius in Scarpa's triangle, and was then deepened to the swelling, which was found to consist of a laminated blood clot, *i.e.*, a false aneurism. While removing the clot, an alarming hemorrhage occurred, which was controlled by compressing the femoral artery against the pubic ramus. The sac was then more widely opened, the clot rapidly removed, and the bleeding found to come from a large vessel on the internal aspect of the sac. The femoral artery in Scarpa's triangle was then exposed as it lay over the sac, and a temporary ligature placed around it. Traction on this ligature in no way affected the bleeding, whereas it was immediately checked by pressure above the pubic arch. With a curved intestinal needle a triple layer of chromic sutures were then passed through the sac wall about the rent in the artery, and the wall of the sac inverted upon the tear so as to constrict it. This stopped the hemorrhage effectively. A potential cavity then remained, which was filled with salt solution. Despite considerable pressure a cavity which held about 600 c.c. of saline solution remained unobliterated. This was packed with gauze, which was gradually removed at three sittings, on the seventh, eighth and ninth days, respectively, and the cavity filled with bismuth petrolatum. No bleeding followed the removal of the gauze.

Seven days after the use of the bismuth, the wound began to discharge, and the patient's temperature, which up to that time had never gone beyond 99°, rose to 103°. The bismuth was thereupon washed out with warm olive oil, and iodine-guaiacol solution injected. A culture

made at this time showed a streptococcus viridans. The discharge ceased after the second irrigation with olive oil, four days later, when the bismuth was entirely removed. The wound gradually healed under the use of the iodine-guaiacol and balsam of Peru, and the patient left the hospital 28 days after the operation with a small, superficial granulating area in the region of the drain, which finally closed on the thirty-eighth day. The clot that had been removed at the time of the operation was sterile, there was no evidence of infection until the fourth day after the injection of the bismuth, and the infection ceased with the removal of the bismuth.

The aneurism was considered as one of the deep femoral artery or a large perforating branch of that vessel, inasmuch as pressure above the pubic arch immediately controlled the hemorrhage.

The rent in the vessel lay almost directly opposite a sharp spike on the upper end of the lower fragment and was undoubtedly produced by this bone spicule.

OSTEOMYELITIS OF THE SCAPULA

DR HITZROT presented a school-girl, seven years of age, who was admitted to the New York Hospital on November 1, 1913, complaining of pain in the right shoulder, with fever and general malaise. Seven weeks before her admission she first complained of pain in the right shoulder-joint, increased by movement, and accompanied by headache, fever and loss of appetite. The pain gradually increased in intensity, the fever persisted and was accompanied by severe chills. About a week ago, a swelling was first noticed in the right axilla, this had gradually increased in size and pressure upon it gave rise to intense pain.

The patient's general history was negative. There was an indefinite history of a fall preceding the onset of the pain, but for at least three days after this injury the shoulder was used without pain.

Examination showed an enormous fluctuating swelling of the right shoulder and pectoral region. The scapula was lifted away from the chest wall, and light palpation over the axilla caused a fluctuant wave to appear close to the vertebral border of the scapula. The whole area was extremely tender, so much so, that the range of motion at the shoulder-joint could not be determined. The child's temperature, on admission, was 103° , pulse 128. A blood count showed 24,800 leucocytes, with 88 per cent of polynuclears.

ULCER OF THE STOMACH

Operation, November 2, 1913. Through a long incision at the pectoral margin of the axilla the abscess was opened, and about a litre of pus evacuated. With the finger in the abscess cavity the scapula was found bare near the neck, and just above this denuded area an opening was found into the shoulder-joint through which the head of the bone could be felt to rotate. A counter-opening was then made along the vertebral border of the scapula, the shoulder-joint was opened between the deltoid and pectoralis major, the joint washed out with saline solution and a split rubber drain inserted. The patient's convalescence was uneventful, although there were still two small, superficial granulating areas near the site of the drainage tube. Motion at the shoulder-joint was restricted in all directions.

An X-ray taken after the operation to confirm the diagnosis of osteomyelitis of the scapula showed a small focus on the anterior surface of the neck of the bone, just to the outer side of the base of the coracoid process. The organism obtained in cultures from the pus was the staphylococcus aureus.

Dr Hitzrot, speaking of the rarity of osteomyelitis of the scapula, said that Treudel, from von Bruns' clinic, reported five cases in 1279 cases of osteomyelitis observed in that clinic.

ULCER OF THE STOMACH PYLORECTOMY

DR HITZROT presented a nurse, forty-six years old, who for thirty years had suffered from indigestion and gastric pain after eating, which was relieved by a rigid diet.

On November 30, 1913, she came to the hospital as a patient of Dr. L. A. Conner, to whom Dr Hitzrot said he was indebted for the details of her general and special examinations. The contents of the stomach, after fasting, showed bright red and altered blood, together with bloody mucus and particles of food. Hydrochloric acid 20, total acidity 40. A number of Ewald test-meals showed hyperacidity, with blood. The stools were examined at frequent intervals, and in four out of seven examinations were found to contain blood. The patient was put on a Lenhart diet, without improvement. An X-ray showed retention of some of the bismuth at the pylorus for 24 hours after its ingestion, although the bulk passed through normally.

Operation, December 16, 1913. The stomach was explored through a median laparotomy wound, and an indurated ulcer found at the pylorus on its inferior aspect. There was a distinctly puckered scar on the antero-inferior surface of the pylorus, to which the gastrocolic

omentum was adherent The stomach was small, but apparently normal

The wide area of induration, the position of the ulcer and its chronicity all seemed to indicate a radical operation rather than a gastro-enterostomy Accordingly, the pylorus and duodenum were freed and clamped, and an inch of the duodenum and about three inches of the stomach were removed The stumps were sewn with right-angle linen sutures and inverted with a double row of chromic sutures A posterior gastro-enterostomy was then done with clamps, and the abdomen closed in layers, without drainage The only technical difficulty encountered was due to the contracted condition of the stomach, its small size making the performance of the gastro-enterostomy rather more difficult than usual

The patient's convalescence was uninterrupted On the morning following the operation she was given hot water, after which she vomited a small quantity of altered blood Hot fluids were given in small quantities every two hours without any distress, and on the sixth day she was allowed solid food, which was well borne She left the hospital on January 6, 1914, twenty-one days after the operation She was now able to enjoy her meals without pain, she ate all sorts of food without discomfort, and no longer dreaded the inevitable necessity of eating

An X-ray, taken just before she left the hospital, showed that the gastro-enterostomy opening was functioning, and that there was no gastric retention

NEPHRECTOMY FOR CONGENITAL ADENOMA IN AN INFANT

DR CLARENCE A McWILLIAMS presented a female infant, who was four and a half months old at the time of her admission to the Presbyterian Hospital on December 9, 1913 The history obtained was that the child's delivery had been instrumental, she was breast fed, and with the exception of a slight cough she had always been in good health The mother thought that the baby's abdomen was always larger than those of her other children, and about ten days before admission there was a noticeable swelling of the abdomen which increased rapidly in size

On admission, the abdomen was found to be greatly enlarged on the right side by a smooth, spherical, non-fluctuating, firm, painless mass, about 20 cm in diameter It was immovable, there was no abdominal rigidity nor tympanites, and the intestines were crowded to



FIG 4 — Adenoma of kidney posterior view

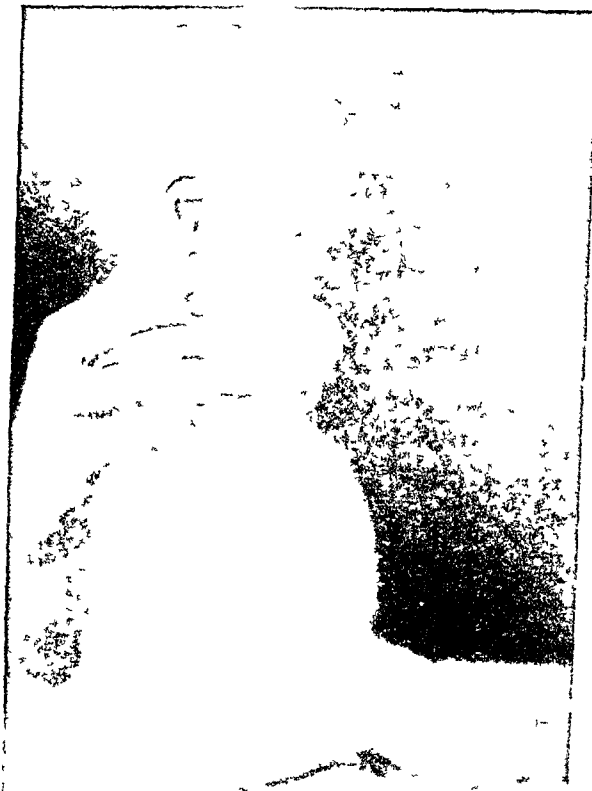


FIG 5 — Adenoma of kidney lateral view



FIG 6 —Adenoma of kidney, gross specimen as removed

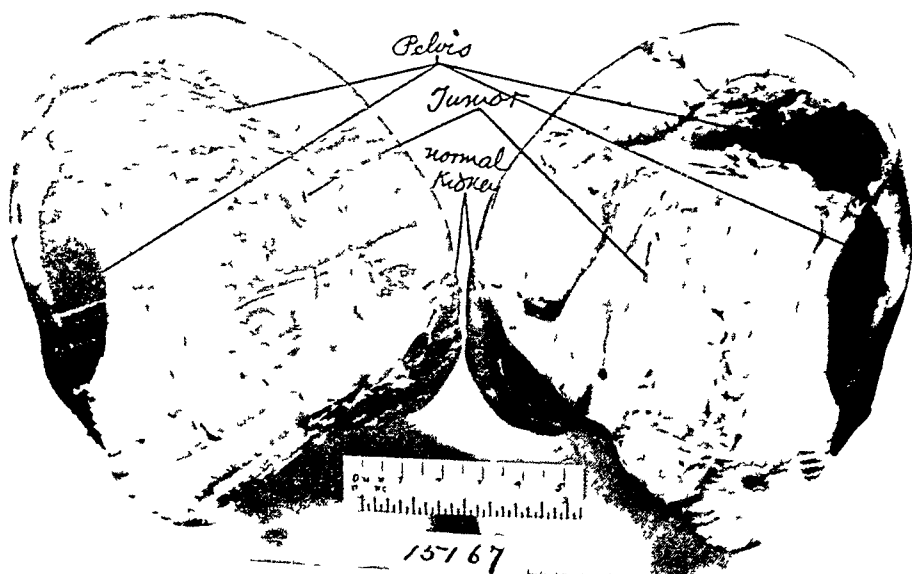


FIG 7 —Adenoma of kidney the specimen bisected

NEPHRECTOMY FOR CONGENITAL ADENOMA

the left side. It was only covered, apparently, by the thickness of the abdominal wall. Neither kidney could be palpated. The mass moved slightly with respiration. It could not be felt in the lumbar region, but by rectal examination there was a tongue-shaped mass, about 12 cm long, with its apex pointing downward, and its base about four cm in width. The tissue of which this mass was composed was firm and apparently homogeneous, it was painless and moved with the elastic mass just above it, with which it was at least continuous. The lowest point of the soft mass was just above the pelvic brim.

The case was regarded as one of sarcoma of the right kidney, and on December 11, 1913, Dr McWilliams did a nephrectomy through an incision extending from the umbilicus outward to the edge of the quadratus lumborum. The gross specimen removed consisted of the right kidney, which was sharply outlined, measuring about 13 cm x 14 cm. The surface of the kidney was smooth, excepting in the area adjacent to the hilum, where there was a certain amount of loose tissue which could be readily separated from the balance of the specimen. On cut section, the entire kidney was found to be made up of a white, homogeneous, soft, soapy material, apparently a tumor, while underneath the capsule, on either side of the periphery of the tumor which presented in the pelvis, there were two solid areas which formed a part of the kidney and were sharply separated from the balance of the tumor proper. Upon injection, cut section showed that the tumor mass extended into the ureter, which was markedly distended and curved upon itself. Pathologically, the tumor proved to be an adenoma of the kidney, with hyperplastic infiltration of the adjacent lymph-nodes.

The operation was followed by a temperature elevation to 104°, with a pulse of 166. After two days the temperature and pulse abruptly fell to normal and remained so. The condition of the wound was entirely satisfactory, and healed primarily excepting at the point of drainage. This area was now granulating satisfactorily. The patient was discharged on December 27, 1913, and was now in excellent condition.

Dr Moschcowitz, in connection with the case presented by Dr McWilliams, showed the specimen from a similar case upon which he had operated about two years ago. The patient was a child of two years that had been injured in falling off a chair. When Dr Moschcowitz saw the patient, a week after the accident, there was a tumor in the left lumbar region, and he made the diagnosis of rupture of the kidney. The child was sent to the hospital, and upon operation a very

peculiar looking kidney was exposed. It was almost cut in half by a large rent, and in the kidney itself was a mass resembling fatty tissue. Death occurred shortly after the operation. The case proved to be one of adenomyosarcoma of the kidney, so-called Wilm's tumor.

These tumors of the kidney, the speaker said, were usually of a mixed type and were very rare.

ACROMIOCLAVICULAR DISLOCATION

DR BURTON J LEE presented a boy of nineteen who, while tackling a runner in a game of football, suffered an injury to the right shoulder, the arm being almost completely dislocated. When he was seen by Dr Lee, about three hours after the injury, an examination revealed a dislocation of the outer end of the clavicle, upward and backward, forming a distinct projection on the outer aspect of the shoulder region. An attempt to reduce the dislocation failed and the arm was temporarily placed in a splint. A second attempt to reduce the dislocation also failed, it being impossible to replace the clavicle completely into its normal position. There was a distinct deformity, with a projection of the outer end of the clavicle upward and backward behind the joint, and a considerable loss of function in the corresponding shoulder-joint.

The patient was admitted to the New York Hospital, and was operated on October 13, 1913. A vertical incision was made from the right acromioclavicular joint downward to the tip of the coracoid process, over the anterior aspect of the joint. This was deepened through the deltoid muscle to the joint region, and the arm replaced nearly into position, but not completely so, the interarticular cartilage apparently forming a definite obstruction. This was therefore removed. The joint surfaces of the clavicle and scapula were then denuded of cartilage with a sharp curette, as it seemed wise to attempt to obtain a firm, fibrous ankylosis which would serve to keep the bones in position after the absorbable suture material had disappeared. A few fibres of the outer end of the trapezius muscle at their attachment to the posterior border of the outer third of the clavicle were then divided, permitting easy replacement of the clavicle in apposition with the acromion process. Three kangaroo tendon sutures were then placed, one through the coraco-acromial ligament and through the clavicle, a second through these same structures, but further outward, and a third through the coracoid process and around the clavicle, holding the bone firmly downward and lying between the first two men-

OSTEOMYELITIS OF THE OS PUBIS

tioned sutures This held the clavicle in perfect apposition with the acromion process The wound was then closed with catgut for the muscles and continuous silk externally

The special features of this operation, Dr Lee said, were the incision from the joint to the tip of the coracoid process, affording free access, the removal of the interarticular fibro cartilage, the denudation of the joint surfaces of cartilage, paving the way for subsequent fibrous ankylosis, the division of a few fibres of the trapezius muscle on the posterior aspect of the clavicle, and, lastly, the three sutures of absorbable material

The after-care of the patient was simple The arm was put up in abduction in plaster coaptation, and the patient was kept in bed for two weeks At the end of three and a half weeks the splint was definitely shortened below, and the arm was placed in a sling The plaster was taken off five weeks after the operation, and very mild passive and active motion was then instituted

On January 15, 1914, the result seemed perfect There was no deformity, function at the joint was normal, and he could hold his arm erect above the shoulder

DR WILLIAM DARRACH said he wished to emphasize the statement made by Dr Lee that in these cases of acromioclavicular dislocation, the crucial point to keep in mind was the rupture of the coracoclavicular ligament, and unless this ligament was repaired, the dislocation was apt to recur In Dr Lee's case, this was done by the third suture, which he passed through the coracoid process and around the clavicle

As to the choice of an incision in these cases, the speaker thought the incision over and parallel to the clavicle gave just as good an exposure as one made at right angles In one of his own cases, operated on several years ago, the removal of the articular cartilage and the meniscus, proved successful Fibrous union was obtained and there was a satisfactory functional result Dr Darrach said that he had seen the coracoclavicular ligament ruptured in five cases

OSTEOMYELITIS OF THE OS PUBIS

DR LEE presented a woman of forty whose general health had been good, and who never had any serious illness up to the present time When she came under Dr. Lee's observation, on July 17, 1913, she stated that four weeks ago she was taken ill with pneumonia A week later a small, painful swelling developed in the suprapubic region Iodine and olive oil were applied at frequent intervals without afford-

ing relief, and the swelling gradually increased in size. Examination showed marked tenderness over the pubic bones, more pronounced on the left side. There was slight induration in the subcutaneous tissue over the same area.

Operation. Two incisions were made directly over the summit of the os pubis, and deepened down to the aponeurotic layer. On incising this, a pus cavity was entered containing two or three ounces of thick, greenish pus. Extending out on either side of the pubic bone there was an erosion on the right side of the summit of the horizontal ramus of the os pubis, and a second erosion on the left side, near the symphysis. These areas were curetted, and the one on the left side enlarged with a gouge. A small gauze drain was inserted down to the summit of the bone, and a few interrupted sutures of catgut inserted at the angles of the wound. The patient made a good recovery.

Bacterial culture of the pus showed streptococci. On account of the recent history of pneumonia, the case was at first regarded as one of pneumococcus osteomyelitis, but this was disproven by the bacteriologic findings.

A CRITICAL ANALYSIS OF THE TREATMENT OF FRACTURE OF THE NECK OF THE FEMUR

DR ROYAL WHITMAN presented a paper with the above title, for which see page 484.

DR L. W. HOTCHKISS said that at the Bellevue Hospital they saw many cases of fracture of the neck of the femur in old women. They formed a class of patients which were not regarded with particular favor, as the treatment extended over a long time, and the outcome, as a rule, was not very promising. Since they had adopted this abduction method of treatment, however, as described by Dr Whitman, they had commenced to take a new interest in these cases, and the results had been distinctly better. By this method, function was restored and union secured, and in many instances the results were unexpectedly gratifying. Some of these patients were in such poor physical condition that the use of a general anæsthetic was contra-indicated, but by this method it was often quite possible, in dealing with recent fractures, to secure sufficient abduction extension without an anæsthetic.

DR H. H. M. LYLE said he had treated six cases of fracture of the neck of the femur in elderly people by Dr Whitman's method. In one, the fracture was of three months' standing before it was recognized. In that patient, who was still under treatment, they were apparently getting union. These patients ranged in age from 60 to 70 years. In

TREATMENT OF FRACTURE OF NECK OF FEMUR

one of them death occurred from an embolus. One of the great advantages of this method of treatment was the comfort enjoyed by the patients, and it was also appreciated by the nurses who had charge of these cases.

DR. HITZROT said he had found this method extremely satisfactory in those cases involving the narrow part of the neck, but not involving the trochanter. In some of the cases he had seen at the New York Hospital, in which the trochanter, especially the greater trochanter, was involved, the results of forced abduction were not as satisfactory as in others.

DR. ROBERT H. M. DAWBARN said that in recent cases of fracture of the neck of the femur, while exudate of callus is still possible, he thought the method of treatment described by Dr. Whitman was ideal, but what were we to do in the late cases, in which the period of exudation had long gone by? In those cases his own method of treatment was to expose the joint, bring the fragments into apposition and hold them together by driving an aluminum spike through the neck and into the head. To excite an exudate of callus, he makes an injection of the glycerite of tannin, which he had found the most efficient of all plans, more efficacious than Bier's use of injected blood without its drawbacks. In one case where he employed this method, the patient was 82 years old, a patient of Prof. W. H. Thompson, who was present at the operation. The old lady was ultimately able to go down and up two flights of stairs as well as before her fracture.

DR. JOHN B. WALKER said that his experience with this method at Bellevue, where they saw a large number of these cases, had been very satisfactory. With the aid of the extension apparatus, which he considered preferable to the help of an assistant, he had been able in many of his cases to apply a serviceable splint without the use of an anæsthetic.

DR. FRANK S. MATHEWS asked Dr. Whitman about what percentage of cases he had found suitable for this method of treatment. Also, in regard to its use in young and old patients. In persons who were very fat, especially in the region of the lower abdomen and buttocks, he had been unable to apply the plaster so that it fitted satisfactorily after they were returned to bed.

DR. WALKER said that in 100 of their cases, 40 per cent. were under 50 years of age. Personally, he had had five cases in persons under the age of twenty.

DR. GEORGE WOOLSEY said he had seen several excellent results by this method, even in patients well advanced in years. In one of his

cases the method was successfully applied ten weeks after the receipt of the injury in a patient about 27 years old. In this case he had Dr Whitman's assistance. He asked Dr Whitman if he advised it in very old and more especially in very decrepit patients, who, if kept in the supine position, were apt to become more and more delirious and to die in a short time.

DR WHITMAN, in closing, said that "to break up an impaction," if this implied the violent separation of adherent fragments, with no adequate means of again apposing them, was doubtless an improper procedure.

The correction of deformity by the abduction method could be accomplished easily by gentle manipulation, secure fixation being immediately assured. Such correction was essential to restoration of function and was furthermore the best means of promoting repair, since the fractured surfaces were placed in proper relation to one another.

In reply to Dr Hitzrot, Dr Whitman said that the method was as efficacious in fractures at the base of the trochanter as elsewhere. That anæsthesia, although not absolutely essential, was indicated usually in order to assure the relaxation of the adductor muscles whose contraction might prevent the proper degree of abduction.

As to the age limit, he thought that the abduction method had a great advantage in the treatment of older patients, since it did not require rest upon the back and permitted frequent changes of posture. Thus, bed-sores and hypostatic congestion might be eliminated as complications. That day, for example, he had applied it to a patient 84 years of age as the only practicable means of relieving pain, and which at least provided an opportunity for repair.

In reply to Dr Mathews, Dr Whitman said that fat patients were difficult subjects for any treatment. In such cases one must depend upon the internal fixation assured by the reduction and by the attitude of abduction, rather than on the accurate fixation of the plaster splint.

It seemed to him that it was most important to establish a standard treatment for favorable cases, in which, under the present conditions, the results were but little better than in the unfavorable class. From this stand-point he would urge the adoption of the abduction treatment because it was based on surgical principles and was the only method by which in a comprehensive sense these principles might be applied.

CARCINOMA OF THE ŒSOPHAGUS

DR KAMMERER showed the specimens of a case of carcinoma of the lower end of the Œsophagus in which a metastasis had formed.

MUSCULOSPIRAL NERVE REUNION

between the trachea and the œsophagus at the level of the manubrium of the sternum. At that point a shadow was found in the X-ray picture. The secondary tumor had compressed the œsophagus and trachea, causing severe dyspnœa, and had finally perforated the tracheal wall, whereas, the primary growth had probably produced no symptoms at all.

INSTRUMENT FOR SECURING REPOSITION OF A FRACTURE

DR HITZROT showed an instrument which could be adjusted to the fragments of a fractured bone to bring them into proper alignment.

The instrument consists of an ordinary mechanical jack which is fastened to the eccentric projecting bar of the lock of two Lambotte clamps by thumb screws. It is applied by first placing one clamp, with the jack attached, to one fragment. Then the second clamp is fastened to the other fragment and so adjusted that the threaded bolt on the jack can be passed through the opening on the lock of the clamp, to which it then is fastened by a thumb screw. By moving the lever of the jack, pressure is exerted against the clamps in such a manner that the two ends of the bone are jacked apart. When the overriding is overcome the ends are manipulated into position by the clamps, the thumb screws tightened and the bone ends are then held in the desired position.

The jack had been successfully used in two cases of fractured femurs. It was designed to obviate the ordinarily violent physical efforts necessary to overcome the overriding in old or recent fractures of the larger long bones and also to keep the mechanical means for doing so directly in the hands of the operator.

*Stated Meeting, held at the New York Academy of Medicine,
March 25, 1914*

The President, DR. FREDERIC KAMMERER, in the Chair

MUSCULOSPIRAL NERVE REUNION TWENTY YEARS AFTER NERVE WAS SEVERED

DR. ROBERT H. M. DAWBARN presented an elderly man who was sufficiently leisurely in his decisions to wait twenty years after a fracture of his left humerus, with complete rupture of the musculospiral nerve in its groove and the usual paralysis accompanying, before deciding to ask for surgical relief.

In this case the severed nerve ends were at length found and united. This was but three months ago, and the man now insisted that his forearm and hand felt warm for the first time in these years, also, the æsthesiometer noted distinct improvement in common sensation. As yet, of course, it was too early to expect motor results.

EXCISION OF THE ELBOW-JOINT

DR DAWBARN presented a woman to show the result of excision of the elbow after a comminuted fracture of the humerus and bony immobility. The patient was first seen by a competent surgeon, who operated by Langenbeck's method, splitting the triceps, which was chiselled off of the olecranon, its insertion into the periosteum being saved. One-half of this triceps end and a portion of the supinator longus were turned in between the joint surfaces after considerable bone was removed, but the result was almost complete rigidity.

The patient was subsequently seen by Dr Dawbarn, who did the operation as formerly taught, but with the removal of the entire lower end of the humerus, from three to four cm, preserving the triceps insertion, as before, on the remaining half. After this operation, as was demonstrated, the motion obtained was excellent in all directions.

Dr Dawbarn commented upon the teaching of the late Dr McBurney, who used to advocate very wide removal of bone ends, if excision was attempted at all. Dr McBurney stated that in his entire experience of many years he had personally had but one case of a "flail-joint" at the elbow, and in that instance the patient had declined a second operation and had made his escape from the hospital.

DR KAMMERER said that during the earlier years of his experience, while working in the clinics of Germany, he had seen many cases of excision of the elbow-joint for tuberculosis. That a flail-joint now and then developed after resection could not be denied, especially after extended removal of bone. In such instances it was questionable whether we should try to get a movable joint, or not. He had seen both methods followed by eminent surgical authorities and he certainly believed that a firm ankylosis, at a little less than a right angle, was preferable to a flail-joint or a nearthrosis with a limited range of motion in a more or less extended position of the elbow.

OPERATION FOR FLAT-FOOT

DR DAWBARN presented a man to illustrate the result of operation for flat-foot. The operation consists of the division of the calcaneum

DOUBLE HALLUX VALGUS

by the Gigli wire saw, from just in front of the tendo Achilles, downward and forward, then sliding the heel, thus loosened, downward and inward as far as possible, and nailing it to the rest of the same bone by a long wire picture nail. The result gives a new angle of support to the heel, and beautifully restored the arch.

Dr. Dawbarn said that after several trials he preferred this method to the Ogston operation. A plaster-of-Paris bandage was applied and left on for six weeks for bony union. For the first three weeks the patient was not allowed to walk at all.

DOUBLE HALLUX VALGUS

DR DAWBARN presented a man upon whom he had operated for this condition by a method which was simplicity itself. It left very little shortening, not over one centimetre. Also, it left a new, comfortable false joint, and the scar was so placed that it was not subjected to pressure. The work was done after thigh constriction, using Schede's moist blood-clot method. A flap, U-shaped, with the convexity just touching the long extensor tendon, was made, the uncut part toward the inner side. With the Gigli saw the head and neck of this metatarsal bone were excised. That was all. The sesamoid bones were not touched, nor was the base of this first phalanx nor the long tendon, not even the bursa, unless suppurating. In that case it must be excised as a primary and wholly separate operation. The plaster-of-Paris splint was removed in six weeks for the first and only time. During the first half of this period no walking was permitted, and the foot was kept elevated.

DR PARKER SYMS said that what was desired by this operation was to give the patient a comfortable foot, and with that end in view it was very important that the scar should not be carried to the inner side of the toe. For this purpose he employed a straight incision made over the dorsum of the toe, well away from the inner side, so that the shoe could not make pressure on the scar. Many of these cases would require an operation such as the one Dr Dawbarn had described, namely, a resection of the head of the metatarsal bone, but the speaker said he did not think it necessary, in the majority of these cases, to do an elaborate operation like the one described by Mayo or Weir. A bunion was simply an inflamed bursa, and would be relieved when the pressure was removed, by removing the offending prominence of bone.

DR JOHN F ERDMANN said he did not think it made any particular difference where the scar lay. He usually made his incision on the inner aspect of the toe, and he had never seen any trouble from the

resulting scar. He invariably dissected out the entire bunion, and did a subperiosteal resection, as in Dr. Dawbarn's case

DR GEORGE WOOLSEY said he usually did the Mayo operation, which he did not regard as elaborate, and quite as ideal as the one described here to-night. He did not think it was necessary to remove so much bone. The results are most satisfactory.

DR DAWBARN, in closing, said he considered his method of treating hallux valgus a most simple and satisfactory operation. It could be done in ten minutes. He never dissected out the bursa unless there was suppuration, and then he did the operation in two stages a month apart. If it was considered good technic to make an incision on the inner side, where the shoe would cause pressure, then it was equally good technic to make an incision on the under surface of the toe. There were two objections to the method mentioned by Dr. Syms: one was that it retained the entire length of the flexor longus tendon and was apt to maintain the bad angle. The other objection was that it violated Bier's principle, in that it left an end-bearing bony surface free of periosteum and exposed to pressure.

COMPLICATED FRACTURE OF THE HEAD OF THE RADIUS

DR WILLIAM DARRACH presented a man, thirty years old, who on March 8, 1913, while riding on a high tower trimming wagon, repairing electric lights, was struck across the chest by a telephone wire which ran across the street. This knocked him off the tower to the street, a distance of about eighteen feet. In his fall he grasped a telephone wire, which broke with his weight, and he could not describe his exact position on landing.

On examination, five hours after the receipt of the injury, there was a prominence on the dorsal aspect of the elbow due to backward displacement of the radius and ulna, with a hollow on each side of the triceps tendon (Fig. 1). There was a wound over the inner aspect of the elbow, but no bone protruding. The elbow was flexed at right angles, with scarcely any active motion. At the wrist there was a markedly exaggerated silver-fork deformity, the carpus and hand being carried well dorsad, with marked prominence anteriorly of the lower end of the upper fragment of the radius and dislocated head of the ulna.

Under ether, the elbow was easily reduced by extending and then pulling the forearm forward, but with its reduction distinct crepitus could be felt, which seemed to be more on the outer aspect of the joint. The wrist fracture was reduced in the same way by extension first and then forward pressure, followed by flexion. An X-ray, taken after the

FIG 1 —March 8 1913

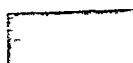


FIG 2 —May 14 1913



FIG 3 —No ember 26 1913

COMPLICATED FRACTURE OF HEAD OF RADIUS

reduction, showed that the radial fragments were markedly displaced, one lying well to the inner side of the coronoid (Fig 2)

On March 14, 1913, under gas and ether, an incision was made over the dorsolateral aspect of the joint, and two of the fragments were removed. A third fragment, however, the one lying most to the inner side, could not be found, and a well protected finger being inserted in search of it revealed a marked laceration of the anterior ligament and the overlying brachialis anticus muscle. The broken surface of the remaining portion of the radial head was found to lie in relation to the lesser sigmoid cavity, so the rest of the head and the neck were removed. The stitches were taken out on the twentieth day, union then being solid, although the wound inflicted at the time of the injury did not close until six and a half weeks later. At this time, April 23, 1913, at the elbow there was flexion to 80° , extension to 115° , with 25° of supination and 30° of pronation. At the wrist there was flexion to 135° and extension to 185° .

On May 7 the elbow showed flexion to 75° and extension to 135° , with 30° of supination and 60° of pronation. The wrist showed flexion to 135° and extension to 190° . An X-ray at this time showed that the fragment of the radial head which had been left behind had acted as a nidus for further growth of bone tissue which extended upward into the substance of the brachialis anticus. The patient was again sent to the hospital, and on May 16, 1913, under novocaine, an incision was made along the outer margin of the pronator teres, and deepened to the brachialis anticus. A bony mass was found firmly imbedded in this muscle and attached to the coronoid process. Gas was then administered, and the greater part of this bony new growth was removed with rongeur forceps and a sharp spoon. The wound was then closed, and a starch bandage applied, with the elbow at 90° . Motions were begun ten days later. On June 28, 1913, the elbow showed flexion to 45° and extension to 140° , while pronation and supination were each limited one-fourth. The wrist showed flexion to 130° and extension to 225° . On November 26, 1913, there was flexion at the elbow to 45° and extension to 150° , pronation and supination, each 70° . The wrist showed flexion to 120° , extension to 210° , adduction 10° and abduction 30° . The mass in the antecubital fossa was much smaller (Fig 3). The patient now complained only of pain along the ulnar head, and a vague soreness in the region of the elbow on rainy or very cold days. On March 19, 1914, there was flexion at the elbow to 40° , extension to 150° , pronation and supination each 70° . There was no pain except a moderate amount at the inferior radio-ulnar joint.

Dr Darrach said the following points of interest were to be noted in connection with this case 1 The association of fracture of the radial head with the dislocation at the elbow 2 The displacement of the fragments of the radial head, this being the indication for operation 3 The intact portion of the radial head being so situated that the broken surface faced the lesser sigmoid cavity This formed the indication for removal of the rest of the head and neck 4 The loose fragment escaping from the joint cavity through the torn anterior ligament and lodging in the substance of the brachialis anticus The further growth of bone from this nidus, corresponding with other instances of myositis ossificans The cessation of growth after incomplete removal of this mass 5 The anterior dislocation of the ulnar head, associated with Colles's fracture This he believed to be of rather common occurrence and frequently overlooked 6 The present disturbance at the inferior radio-ulnar joint, due to the relative lowering of the ulnar head Ordinarily, this condition could be greatly benefited by an ostectomy of the lower extremity of the ulna, but in view of the previous removal of the radial head and neck, the procedure seemed questionable in this instance

RUPTURE OF THE AXILLARY ARTERY AND VEIN, WITH INJURY TO THE FIFTH AND SIXTH CERVICAL NERVE-ROOTS AND COMPRESSION OF THE BRACHIAL PLEXUS

DR JOHN A HARTWELL presented a young man, a chauffeur, who, in June, 1913, while sitting on the floor and running-board of an automobile travelling at high speed, met with a collision and was hurled from the car He was uncertain as to the exact way in which he received the injury, but on careful questioning it appeared that he was thrown bodily free from the car and, in trying to save himself, he grasped some portion of the car with his right hand This resulted in a violent abduction and extension of the entire right arm, the car travelling in one direction and he being hurled with great force at an angle, producing a powerful tearing violence in the region of the right shoulder girdle He was picked up from the roadside, and taken immediately to the hospital

Examination showed complete paralysis, both motor and sensory, of the entire right upper extremity, including the shoulder girdle muscles, and loss of pulsation in the entire extent of the axillary, brachial, radial and ulnar arteries There was no evidence of any external injury, and very little tenderness around the upper extremity There was no hæmatoma He was kept under observation in the hospital for six weeks, during which time there was no change in his condition excepting the development of very marked atrophy of the muscles over

the shoulder, and, to a lesser extent, those of the arm and forearm. There was practically no return of motor function, but there was a slight return of sensation along the radial distribution in the hand. At no time was there any suspicion of gangrene from the apparent loss of circulation, and there always seemed to be sufficient blood in the fingers. The pulse, however, never returned.

Operation, August 15, 1913. An incision was made in the upper part of the neck to expose the origin of the cervical nerve roots, and at this point it was found that the fifth and sixth roots, after their emergence from the intervertebral foramen, showed definite thickening from an inflammatory exudate. It was not deemed advisable to open the vertebral canal, but the tension of the roots was relieved by making parallel, longitudinal incisions into the tumified nerve-trunks.

A second incision was then made in the pectoral region. A part of the pectoralis major muscle was divided, and the pectoralis minor drawn toward the midline. This gave an effective exposure of the infraclavicular structures. The axillary vein was found to be completely ruptured and the ends sealed by an incurling of the vessel. The axillary artery, for a distance of about two inches, was represented by a fibrous cord, and there was no pulsation in the artery beyond this point. The structures of the brachial plexus were bound down by very firm scar tissue, pressing them against the first rib. This scar tissue was dissected off, giving entire freedom to the brachial nerves. No attempt was made to repair the vessels, but great care was taken throughout to cut no vessels that might be taking part in the anastomotic circulation.

Since the operation the patient had regularly received massage and electrical treatment throughout the whole extremity. There had been a very marked return of both motor function and sensation to all parts excepting those supplied by the fifth and sixth roots. There had been no return of pulsation in any part of the artery. There was a persistent paralysis of the supraspinatus, the infraspinatus, the deltoid, the teres major and minor, and, to a lesser extent, of the muscles of the upper and forearm. However, since the paralysis was not complete and seemed to be slightly improving, it was evident that the fifth and sixth roots were at least partially functioning, and there was therefore hope that still further improvement would take place and that the patient might ultimately have a fairly useful arm.

The unusual features of this case which made it worthy of record, Dr. Hartwell said, were the two distinct lesions of the nerves: first, at their origin from the cord, and, second, in the infraclavicular region.

The complete rupture of both artery and vein with the immediate establishment of a collateral circulation, was also an unusual feature. It was apparent that the artery was so stretched that all of its coats excepting the adventitia had ruptured, and the curling up of the inner coats prevented either aneurism or hemorrhage. In most of the reported cases of similar injuries, gangrene had either supervened or at least threatened.

DR ARTHUR L. FISK said that some fifteen years ago, at a meeting of this Society, he presented a young man, a plumber's helper, who was struck on the right shoulder by a falling pipe. He was taken to a hospital, where a diagnosis of fracture of the clavicle was made. Subsequently, he was transferred to the Trinity Hospital, where it was noted that he had no sensation in the hand on the affected side, and that there was no fracture of the clavicle. Operation revealed a complete rupture of the brachial plexus, together with the subclavian artery and vein. The vessels had been crushed, and there was no hemorrhage into the tissues. Gangrene finally set in, and the arm had to be amputated. No shock nor hemorrhage attended this operation. In this case, as in the one shown by Dr. Hartwell, there was no external evidence of injury.

DR ERDMANN said he was recently called upon to amputate at the shoulder the arm of a young man of 23 who was injured in a street-car accident. Following the injury, there was a large swelling at the shoulder, with complete loss of motion and sensation, and absence of pulsation. The arm was thoroughly blanched. A high amputation was refused until thirty-six hours after the injury, when gangrene was well advanced. Upon splitting the pectoralis major, a small blood clot was found, otherwise, there was no evidence of hemorrhage. The axillary artery had its inner coats torn and crushed, and the veins were completely severed. The condition of the brachial plexus was not made out, but there was probably an evulsion of the nerve-roots.

DR TAYLOR said that in the case shown by Dr. Hartwell most of the trunks of the brachial plexus were involved in the large cicatrix, which probably accounted for the paralysis of the lower part of the extremity and also for the improvement that had occurred. The marked atrophy of the infra- and supraspinatus pointed to injury to the fifth and, possibly, to the sixth roots. The disability of the shoulder muscles would probably be permanent.

DR HARTWELL, in closing, said the arm showed no evidences of gangrene or interference with the circulation, barring the fact that there was a complete absence of pulsation. One could see by the coloring of the nails that there was some blood supply. The absence of the

LAMINECTOMY FOR SPINAL TUMOR

pulse was at first attributed to a possible anomaly in the course of the blood-vessels

DR FISK said that in his case there was some circulation in the arm for two days after the injury, probably due to some collateral circulation

EXTRADURAL CYST IN SPINAL CANAL

DR ALFRED S TAYLOR presented a girl who was sixteen years old at the time she was operated on in May, 1913—about ten months ago. For eighteen months preceding that date she had increasing difficulty in locomotion, with dragging of the right foot and leg, until she finally became bedridden. There was no history of pain, but at the time of the operation there was complete spastic paraplegia, with marked increase of the reflexes of the lower extremities, and hypæsthesia up to the level of the fifth intercostal space on the left side and to the level of the fourth space on the right side. The patient was seen by Dr Charles L Dana, who thought that while the presence of a spinal tumor was not positive, an exploratory operation was well worth while.

On May 22, 1913, Dr Taylor did a right hemilaminectomy, including the fourth, fifth and sixth dorsal vertebræ, and exposed an extradural cyst, which was enucleated. The dura was not involved, and after puncture was left alone. The patient made an uneventful recovery, and within three or four weeks after the operation she was able to move the toes and feet. From that time on her progress became more rapid, and she could now walk about with perfect freedom. There was no ataxia nor other disturbance. The symmetry and mobility of the spine had not been impaired by the operation.

LAMINECTOMY FOR SPINAL TUMOR AND OTHER SPINAL DISEASES

DR CHARLES A ELSBERG presented a number of patients in order to show the results that could be obtained after operative interference in various spinal conditions.

The first patient was a woman from whom he had removed a glioma which pressed upon the cord at the tenth dorsal segment. The patient had severe root pains over the left lower abdomen for two years and had been treated for various diseases for several years before the real nature of her trouble had been recognized. The removal of the tumor was followed by a rapid disappearance of the symptoms, so that within three weeks she was practically free from any complaints.

The second patient was a woman who had a typical Brown-Sequard syndrome, with indefinite signs at the sixth dorsal level. At the opera-

tion, a small extramedullary growth was removed. Here again the improvement was rapid. A complete paralysis of the left lower extremity had existed before the operation, but within four weeks, the patient was able to walk, and in two months had entirely recovered.

The third patient shown had been operated upon less than six weeks ago, and a fibroma removed from the tenth dorsal segment. The patient had been almost completely paraplegic before the operation. The recovery in this case was very rapid, so that the patient could be presented walking around without assistance, and with practically no evidence of the former paralysis.

Another patient had an intramedullary growth at the level of the sixth cervical segment which had been removed by Dr. Elsberg ten months before by means of the extrusion method. This patient had been quadriplegic before the operation, and she was presented in order to show how good a result could be obtained by the extrusion method of treatment of intramedullary tumors.

Another patient was shown who had been operated upon twice for an extradural tumor which had caused marked compression paraplegia of all four extremities. The patient improved very much after each operation, so that she was able to walk around alone and make considerable use of her hands and fingers. At the first operation, a small extradural tumor was removed, and the bleeding from the bone controlled by means of bone wax with which the entire cavity in the bone was filled. The patient improved astoundingly and remained in good condition for about one year. Then the symptoms rapidly returned, and, at a second operation, a tumor was found which again compressed the cord. The tumor mass was found to consist of the wax which had been inserted at the previous operation and which had been pushed out of its bed by a recurrence of the tumor growth. The wax was removed, together with as much as possible of the tumor, and marked improvement followed.

Another patient presented a spastic paraplegia and all of the symptoms of a spinal tumor at the level of the second dorsal segment. At the operation, a very marked localized thickening of the dura was found which had caused the pressure upon the cord. Over an area of about one inch, the dura was at least one-half inch thick. Excision of the thickened dura was followed by steady improvement. There was no history of syphilis in this patient, and the Wassermann reaction was negative. The diseased tissue that was removed was reported by the pathologist as chronic inflammatory tissue. Dr. Elsberg declared that the condition found was a most unusual one.

LAMINECTOMY FOR SPINAL TUMOR

A case of unusual interest presented by the speaker was one of a young man who had suffered for the best part of one year with steadily increasing symptoms of spastic paraplegia. He had been in the N Y Neurological Institute several times during the year, and was considered a case of multiple sclerosis. Finally, he was bedridden, with tremendous spasticity of both lower extremities, but with only slight disturbances of the pain and the temperature sense. As there was some slight evidence of level symptoms, and because the patient begged to be given the smallest chance for relief, an exploratory laminectomy was done. The seventh, eighth, ninth, and tenth dorsal spines and laminae were removed, and the dura widely opened. Nothing abnormal was discovered, although the spinal cord felt somewhat irregular and "lumpy." The patient was presented practically free from all of his symptoms, he was able to be about and to walk ten miles at a time. The speaker stated that he had seen a similar remarkable result in two other patients with probable multiple sclerosis. He did not attempt to explain the reason for the improvement, but stated that Dr. Bailey and he had considered that the entrance of air into the dural sac might cause a profound influence upon some pathological cord conditions, and in a paper by Bailey and Elsberg on "Decompressive Laminectomy" their views had been set down in detail.

Finally, a physician was presented who had suffered a fracture of the cervical spine with compression paraplegia three days before she was operated upon. The operation showed that the spinal cord was compressed by the laminae of the sixth and seventh cervical vertebrae, and steady improvement followed the removal of the fractured bone and a wide laminectomy.

LAMINECTOMY FOR SPINAL TUMOR

DR CHARLES A. ELSBERG read a paper with this title, for which see page 453.

DR FOSTER KENNEDY (by invitation) said he had had the opportunity of examining many of the cases reported by Dr. Elsberg, and he felt, with the reader of the paper, that the outlook for operative interference in many conditions of the spinal canal and cord was exceedingly hopeful. This was well illustrated by the results obtained by Dr. Elsberg, and one of the most striking instances was the case of syringomyelia with the formation of a definite intramedullary cyst, which was operated on by incision into the posterior columns. There was no other treatment for such conditions other than that described by the reader.

of the paper, and the successful outcome of the operation in the case referred to justified their anticipations for other cases. Syringomyelia, in the text-books, was described as invariably due to an embryonic defect, but we would probably be forced to modify our views with regard to this disease, which was much more common than was formerly imagined. The symptom-complex which went by the name of syringomyelia was a clinical rather than a pathological entity, and its symptoms could be produced by varying conditions of the cord. Dr Kennedy said he had under his observation at present a woman with the history of lues, who recently developed a condition which could only be called syringomyelia and which he hoped might be successfully treated by operation. A hæmatomyelia might produce a similar clinical picture, particularly in cases of syphilitic origin. The same was true of endarteritis producing an anæmia of certain segments of the cord, with the breaking down of certain elements of the cord and the production of a cyst, and the speaker said he had no doubt that such a condition was amenable to skilful operation. With a hæmatomyelia, however, operation was not necessarily indicated, as improvement in the symptoms might be expected.

When we came to the diagnosis of spinal lesions, we found in the text-books a number of fairly well defined rules by which we could distinguish between extra- and intramedullary tumors and other conditions. By exercising the greatest care, it was usually possible to say precisely at what level the cord was involved, but that did not throw much light upon the character of the lesion, and while we could theorize indefinitely in favor of this or that lesion, the final court of appeal often lay in an examination of the cord itself. Formerly, Dr Kennedy said, he looked upon laminectomy as a serious major operation. It still was to be so regarded, but he had now seen so many of these operations and with such success that he had come to the conclusion that where we had to deal with a spinal cord lesion that gave rise to definite symptoms of compression at a definite level, then a surgeon should be called in.

DR GEORGE WOOLSEY said that in one case that had come under his observation, there was no nerve-root pain and little sensory disturbance, although a large tumor was found extending under five or six laminae on the dorsal aspect of the cord in the cervical region. This patient, for nine years, had suffered from increasing motor symptoms. The tumor was a small-celled sarcoma and the case was the only one that resulted fatally. In a case of extradural fibrosarcoma, the only extradural case he had operated on, there was a recurrence within a year after

LAMINECTOMY FOR SPINAL TUMOR

the removal of the growth. It was again removed and a second recurrence was confidently looked for, but the patient was now well, eight and a half years after the second operation, with the exception of a slight spasticity involving the left arm and leg.

The results in these cases, as emphasized by Dr. Elsberg, depended largely on the patient's condition and the length of time that pressure had been exerted on the cord. In one of Dr. Woolsey's cases the symptoms of pressure dated back for twelve years, and still considerable improvement had resulted from the operation. He had seen relief of symptoms from laminectomy when no tumor was found, but not to the same extent as in the remarkable cure shown by Dr. Elsberg. The speaker said he could recall a few cases of extramedullary tumor with symptoms simulating those of an intramedullary growth in respect to dissociated anæsthesia. In several cases, on exposure of the cord, the growth at first appeared intramedullary until a division of several layers of condensed arachnoid tissue disclosed an extramedullary growth.

DR. TAYLOR said that twenty years ago a laminectomy was regarded as one of the most difficult and serious of operations, but it could no longer be looked upon in that light. That fact had been illustrated by Dr. Elsberg as well as by his own work, which embraced some fifty or sixty cases with only two or three deaths. One of these fatalities was from septic pneumonia which was indirectly due to the operation. After an operation of this kind, the patient was seldom, if ever, in a worse condition than before, and the chances of improvement, whether one found a tumor or not, were very promising. He had seen cases of total paraplegia, dependent, apparently, solely upon an intense congestion of the cord, entirely clear up after an exploratory operation. Such an operation, the speaker thought, should be done much more frequently than it was at present. In one case of tumor involving from the eighth cervical to the first dorsal level, the growth was found to be extradural, and was removed. It was submitted to Dr. James Ewing, who pronounced it malignant Hodgkin's disease, and said that in this location it was never primary. In verification of this statement, Hodgkin's enlargement of the glands in the neck developed shortly afterwards.

DR. ELSBERG, in closing, said that excluding operations for fracture up to recently, he had an unbroken series of 61 laminectomies without a death.

TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY

Stated meeting, held March 2, 1914

DR JOHN H GIBBON, President, in the Chair

BONE TRANSPLANTATION (ALBEE OPERATION) FOR SPINAL TUBERCULOSIS

DR JAMES K YOUNG reported the following cases.

CASE I—David S, aged twenty, male, born in Russia, was admitted to the Polyclinic Hospital, November 21, 1913, suffering from tuberculosis of the spine in the lumbar region

Previous History—Two years ago while at work in the country, in Russia, he was injured by being thrown against a door and striking his back, was confined to bed for one week, and worked one week, when he noticed the bone projected backward, he was advised by a physician to have an apparatus applied, but refused. The deformity increased and he was unable to work.

Present Condition—On admission there was marked kyphosis in the lumbar region, including the first and fourth lumbar vertebræ, with deferred pain and weakness, but no paraplegia. On November 22 Dr Young did a bone transplantation operation, taking the graft from his left tibia. The convalescence was uneventful. He wore a plaster case ten weeks and has since worn a brace. The symptoms disappeared and the spine is ankylosed.

CASE II—John B, colored, male, aged twenty-four, was referred to the Polyclinic Hospital by Dr David Reisman. In addition to a tubercular lesion of one of his pulmonary apices he had a well defined tubercular kyphosis in the dorsal region. The usual signs of pressure, pain and muscular spasm were present, but no paraplegia. On June 18, 1913, was done a bone transplantation operation, taking the graft from his tibia, a plaster-of-Paris cast was worn for seven weeks. There was nothing unusual in the convalescence and a fixation of his spine caused an improvement in his symptoms. Upon removing the

happy effect on the joints, as the ankle, knee, wrists, etc. He called attention to a treatment by Parker, of Chicago, for the prevention of scars after burns. He showed several patients he had treated by strapping with zinc oxide plaster and fixing the parts in plaster-of-Paris splints. This plaster was removed at intervals, and by keeping the elbow, axilla, and groin straight and fixed, contractures did not occur in the patients shown.

DR J. TORRANCE RUGH said that he had had some experience with the use of fibrolysin. He had the privilege of seeing one of Mr. Tubby's cases last summer and in that case Mr. Tubby did not dissect out the scar tissue in Dupuytren's contraction, but simply scarified the parts and rubbed in the fibrolysin, and the result was a most satisfactory one and there was complete correction of the contraction.

Quite some years ago, following an operation on the heel tendons, a rough callus developed over the site of the scars. He gave thiosinamine by mouth for three months and secured absorption of the scars, the tissue becoming soft like the other skin. Recently in a similar case, he injected fibrolysin in the patient with the same type of result, absorption of the redundant scar and a perfectly normal skin over the top of the old thickened hardened scar.

In a case of congenital Dupuytren's contraction in the fingers in a girl of 13 he used perhaps six injections of fibrolysin, and since then had had the finger on a splint for the purpose of firm extension. The only effect of the fibrolysin observed in this case has been a marked softening of the tissue. It has not now the density which it had before he made the injections, but he was having difficulty in extending the finger because of the contraction of the ligaments on the palmar surface of the joint.

DR L. H. MUTSCHLER said that he was called at 5 o'clock in the morning to see a man, about sixty years of age, who had been suffering for a number of months with articular rheumatism. He had had one injection of fibrolysin the afternoon before. He had had a collapse, became short of breath, perspired profusely and everyone thought he was going to die, he seemed to have recovered somewhat by the time he was seen by Dr. Mutschler, being in fairly good shape though still a little delirious. The next day his physician gave him fibrolysin again in half the amount of the first dose, and the patient again became delirious. The last heard of him he had a nurse taking care of him. He had never had any such attack previous to this treatment.

DR EMORY G. ALEXANDER (in closing) said, with regard to the effects of fibrolysin, there were no bad results in the administration of the drug in the case of the patient reported, and he had also noticed

older class of patients it is the ideal operation. There is one feature of the operation which, however, has brought rather disastrous results in a certain number of cases, and that is that the graft is made too short. It does not extend a sufficient distance above and below the site of disease to give a firm hold and a firm support, and the cases which have done badly and where the deformity seems to have recurred, have been due to that fact.

The method, as shown by Albee, is to expose the spine, prepare the site for the insertion of the graft, and then measure the length of graft desired and take it from the leg. It would be difficult to gauge the exact length of the graft needed unless the area for the insert has already been exposed.

In the younger cases, under twelve years, the Hibbs' operation has a distinct place. This consists in the utilization of the spinous processes for securing a bridge of bone along the posterior column. In a case in which a total paralysis had been present for eight months this disappeared absolutely in about two months after a Hibbs' operation and the patient is now walking about with practically no support and with a good firm spine. The Hibbs' operation is very easy in the child but difficult in the adult.

DR JAMES K. YOUNG (in closing) said, in regard to the size of the graft, he used a wooden sterile tongue depressor on which he measured the vertebræ, and his assistant was then able to take out the part marked while he was preparing the spine for its insertion. The operation is easily performed in twenty minutes. He had found the osteotome better than the electric saw.

There is no age limit, but the shock is less after eight years of age. He takes the periosteum with the transplant, and Dr Albee suggested always scarifying the transplant in the longitudinal direction, while Dr Galloway suggested scarifying it in the opposite direction, so he scarified it in both directions so that the osteogenetic layer of the periosteum of the graft will unite with the bone of the vertebræ.

A TREATMENT OF OLD CONTRACTED CICATRICES

DR EMORY G. ALEXANDER presented a paper with the above title, for which see page 450.

DR JAMES K. YOUNG said, in regard to fibrolysin, he had had some experience with its administration, and had found it could be used quite extensively. He had given one patient 94 injections without any bad effects. The drug is often tasted in the mouth, so that evidently it goes through the body, and in arthritis deformans it has a peculiarly

happy effect on the joints, as the ankle, knee, wrists, etc. He called attention to a treatment by Parker, of Chicago, for the prevention of scars after burns. He showed several patients he had treated by strapping with zinc oxide plaster and fixing the parts in plaster-of-Paris splints. This plaster was removed at intervals, and by keeping the elbow, axilla, and groin straight and fixed, contractures did not occur in the patients shown.

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DR EMORY G. ALEXANDER (in closing) said, with regard to the effects of fibrolysin, there were no bad results in the administration of the drug in the case of the patient reported, and he had also noticed

in the literature that many people recommend giving it intravenously. They claim it produces a nauseating effect sometimes but aside from that he knows of no ill effects at all

This boy's arm had completely healed when he was again injected a week ago, which has caused the breaking down at the elbow which he exhibits at present

DR A W TUCKER (by invitation) presented "Some Experiences in Surgical Practice in the Orient"

OBLIQUE SUBTROCHANTERIC FRACTURE OF FEMUR

DR LOUIS H MUTSCHLER reported this case, not because it is of an unusual nature or of rare occurrence, but to show the excellent results that may be obtained by the open treatment of fractures in contrast to those obtained by the older methods. This woman, 35 years of age, was admitted to the Episcopal Hospital, May 29, 1913

While attempting to alight from a wagon her skirt caught and she fell to the ground, striking her right hip. She was unable to stand and was brought to the hospital. She was poorly nourished, anæmic in appearance and extremely nervous. She complained of pain in the region of the right hip, the right foot was everted, crepitus and preternatural mobility were felt just below the joint. The right extremity was one and a half inches shorter than the left. A fracture of the upper third of the femur was diagnosed

Treatment a Buck's extension with weights was applied and a sand bag placed on each side of the limb. An X-ray picture was taken a few days after admission, and showed an oblique subtrochanteric fracture of the right femur

The deformity was typical of this kind of a fracture. As is shown in Fig 1, there was marked displacement, the upper fragment was abducted and tilted forward, the lower fragment was adducted and overlapping the upper fragment to the extent of about one and one-half inches. The line of fracture was oblique from above downward and outward, this being the usual line of direction of fractures in this location

On June 8 an attempt was made, under chloroform anæsthesia, to reduce the fracture and the limb was again placed between sand bags, in an elevated, abducted position, with twenty pounds of extension

A second X-ray picture, taken four days later, showed the fragments to be in about the same displaced position. He had considerable difficulty in persuading the patient to consent to an operation. After several days, however, she decided to undergo an operation and it was

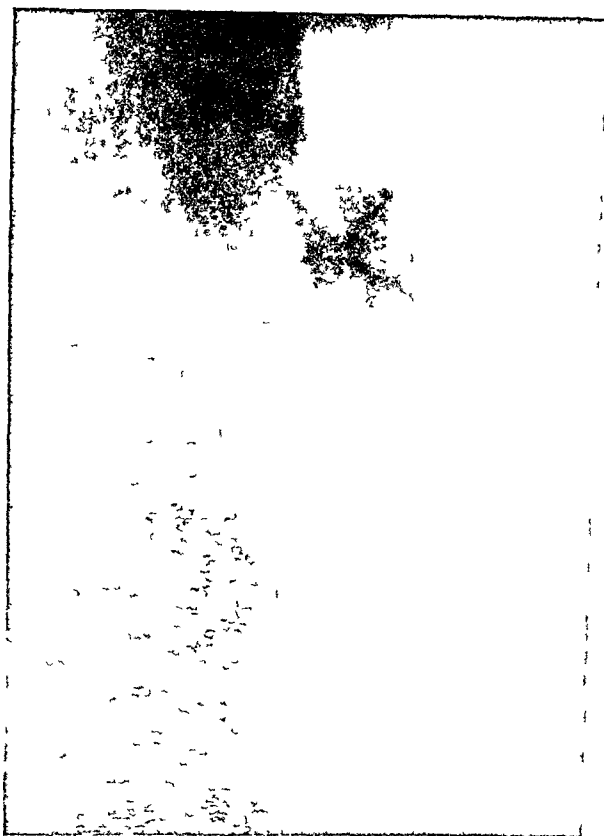


FIG 1 —Subtrochanteric fracture of femur with displacement

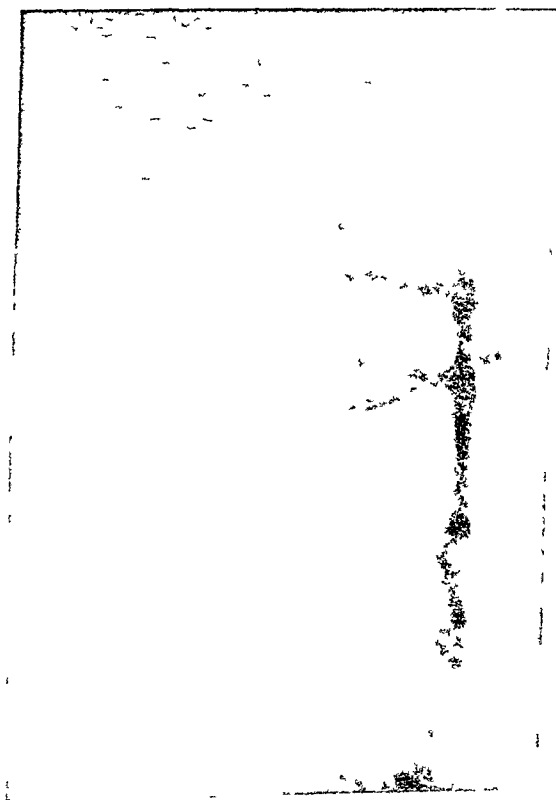


FIG 2 —Fracture plated and wired

OBLIQUE SUBTROCHANTERIC FRACTURE OF FEMUR

done under ether anæsthesia on June 13, fifteen days after the accident

An incision, about seven inches in length, was made on the outer side of the thigh over the seat of fracture. After exposing and freeing the ends of the fragments from soft tissues he had great difficulty in reducing and holding the fragments in proper position. A Sherman plate with two screws into each fragment held them in place, and, as an extra precaution, he placed a silver wire around the ends of the fragments and over the plate at right angle to the line of fracture. The wound was then closed and a small gauze wick inserted for drainage. The limb was placed between sand bags with light extension.

The wick was removed the third day and the patient made an uneventful recovery. She was permitted to get out of bed after a period of nine weeks and left the hospital walking with the aid of crutches.

Her limb was in good position and each lower extremity measured thirty-five inches when discharged (see Fig 2). He saw this woman on December 12, 1913, and she was walking about without the aid of crutch or cane. She was attending to her usual housework and went up and down stairs normally. There was no difference in the length of the lower extremities and, with the exception of some slight soreness in the thigh during damp weather, she said she felt perfectly well.

Subtrochanteric fractures of the femur may occur at any age, but are uncommon. Articles describing fractures of the femur, just below the trochanter major and minor, are found among the writings of a hundred years ago. It is interesting to note in this literature how carefully fractures of this nature were studied and described and how accurate are the drawings made from post-mortem specimens. These writers dwell at length upon the marked displacement and resulting deformity and the difficulty encountered in attempts to reduce and maintain the fragments in proper position.

Sir Astley Cooper says "The thigh-bone is sometimes broken just below the trochanter major and minor, it is a difficult accident to manage and miserable distortion is the consequence if it be ill treated."

To quote Amesbury "When the fracture is just below the trochanter minor the retraction is sometimes not less than seven or eight inches." This amount of shortening is excessive and probably is seldom seen.

Malgaigne, after fully describing his method of treatment of the type of fracture under consideration, says "And even with all this, success is very difficult to obtain." The foregoing quotations give a

good idea of the discouragement the early surgeons encountered in treating fractures immediately below the trochanters

You could not expect, however, these surgeons to obtain better results if the surgeon of to-day, even with the assistance of the X-ray, is usually unable to obtain satisfactory results without resorting to the open treatment. By so recent and able an authority as Scudder we are told that treatment of subtrochanteric fractures by extension and counterextension and the use of the inclined plane are usually ineffective.

The displacement of the upper fragment is due to the action of the iliopsoas and to the rotators fastened to this portion and the retraction and adduction of the lower fragment to the strong muscular contraction of the adductors, probably caused in part by the irritation of the sharp end of the fractured bone. The early treatment of fixation of the pelvis, extension with counterextension, abduction, placing the thigh on an inclined plane, immobilization, etc., has continued with little or no modification up to the present time.

Much has been learned concerning fractures since the discovery of the Rontgen rays. Diagnoses of fracture have been made only to be reversed by the skiagraph. More frequently fractures have not been diagnosed and later have been demonstrated by the X-ray. It is by this means alone that we can positively tell the kind of fracture and the true position of the fragments. It is of the utmost importance, when possible, to have X-ray pictures taken in planes at right angles to each other, otherwise the true deformity is not always shown.

In many cases in which the fragments have united and resulted in good normal function of the part, the skiagraph has revealed the existence of a decided deformity.

The recent interest in and the progress that has been made in what is known as the open treatment of fractures with proper replacement and fixation of the fragments by one of the several methods have been the means of obtaining infinitely better results. The principal objection to the operative treatment is the fear of infection.

If in these days of advanced aseptic surgery we are not reluctant to open the peritoneal or cerebrospinal cavity, why should we hesitate to cut down upon a fractured bone? The X-ray will show the fragments to be in good position in many cases of fracture and obviously no operation is indicated. In those cases, however, with marked and obstinate deformity, like the one under consideration, he believed the open treatment should always be employed, providing the patient's condition permits.

BOOK REVIEWS

SURGERY. ITS PRINCIPLES AND PRACTICE For students and practitioners By **ASTLEY PASTON COOPER ASHHURST, A B, M D, F A C.S**, Instructor in Surgery in the University of Pennsylvania, Associate Surgeon to the Episcopal Hospital, and Assistant Surgeon to the Philadelphia Orthopædic Hospital and Infirmary for Nervous Diseases 1141 pages, 7 colored plates and 1032 illustrations in the text. Philadelphia and New York. Lea and Febiger, 1914.

THE entire field of the principles and practice of surgery is amply covered in this book with the exception of the specialties of the eye, ear, nose and throat Genito-urinary surgery, gynæcology and orthopædics have been referred to only in so far as the author believes them to come within the province of general surgery Emphasis has been placed on the underlying principles of surgery and pathogenesis, diagnosis and indications for treatment are well worked out In a book of this size it is easily understood it is not possible to describe all methods of treatment, or even all of the better methods of treatment, however, the author has made a wise selection, though here and there there is room for difference of opinion as, for example, in the operation for cleft palate, the operation of Lane not being described The author's style for the most part is admirable The illustrations are excellent, for the most part original, and complement the text admirably. The author has carried out his purpose, as expressed in the preface, to furnish a foundation on which a knowledge of surgery may be built It is intended primarily as a text-book for students and as such fulfils its purpose and is to be recommended

RUSSELL S. FOWLER

PRINCIPLES OF SURGERY By **W A BRYAN, A M, M D**, Professor of Surgery and Clinical Surgery at Vanderbilt University Octavo, 677 pages with 224 original illustrations Philadelphia and London. W B Saunders Company, 1913

THIS book is not intended for a book of reference but should be read during moments of leisure and time taken to thoroughly assimilate its contents It will be most valuable to the undergraduate student

The author has endeavored to teach in a simple and logical way some of the basic principles of physiology, anatomy, pathology and

BOOK REVIEWS

surgery that are essential to a thorough understanding of disease, in its many forms, as seen by the surgeon, and that govern all successful efforts at relief

There are forty-seven chapters, each dealing with some particular phase of surgery, such as inflammation, sepsis, shock, anæsthesia, tumors, etc

There is a comprehensive description of vaccines and their uses

Bone grafting has a place of its own following skin grafting. The principles laid down are strictly in accord with the most recent experimental work. This section well illustrates the fact that a knowledge of nature's laws and painstaking care brings success, while ignorance and carelessness are synonymous with failure.

The emphasis and detail used in elaborating the non-operative treatment of tuberculosis, especially the general treatment, minute directions for the use of tuberculin, and heliotherapy deserve especial commendation, but some would criticize the interchangeable way in which "tubercular" and "tuberculous" are used.

There is a careful description of the diseases caused by fungi, sporotrichosis, actinomycosis, and blastomycosis.

In speaking of shock all debatable points are avoided and only the commonly recognized factors are dealt with.

The Meltzer and Auer and the Elsberg apparatus are recommended for use in respiratory failure, but the simpler pulmotor or lung motor is not mentioned.

One-third of the book is devoted to a discussion of tumors, the following outline being used, in a general way: Classification, etiology, minute structure, sites of formation, diagnosis, special symptoms in various organs, prognosis, and treatment.

By a curious coincidence sarcoma and cancer each have 58 pages. Here the author has drawn most largely on personal experience and this portion of the book is replete with valuable information covering all the phases of the subject and enriched by excellent X-ray pictures and unusually good microphotographs.

The classification of cysts is an elaborate one.

There is a good working index.

This book, like a road map, points out the beaten highways and leaves the by-paths and forest trails of surgery for further individual exploration.

HENRY F GRAHAM

CORRESPONDENCE

A PARAMEDIAN CÆLIOTOMY INCISION

TO THE EDITOR OF THE ANNALS OF SURGERY:

The retrorectus laparotomy incision, described by Dr John J Moorehead in the ANNALS OF SURGERY, December, 1913, p. 828, has the grave defect of interfering with the nerve supply of the rectus muscle, and, in the event of the incision requiring extension upward and downward to nearly the whole length of the abdomen, the rectus will have most of its nerve supply cut off

This interference with the nerve supply, being avoidable, is unnecessary

The following method of paramedian cœliotomy, which I have employed for many years, has no claim to originality, but possesses the advantages of (*a*) preserving the nerve supply to the rectus, (*b*) being capable of extension, either upward or downward, without injury to nerves, (*c*) producing a solid cicatrix

The steps of the operation are 1 A vertical skin incision, one and a half inches from (and usually to the right of) the middle line. 2 Incision of the anterior rectal sheath, in the line of the skin incision 3 The rectus muscle is peeled off the posterior sheath and peritoneum, from the middle line outward, and is held outward with retractors 4. Incision of the posterior rectal sheath (where present) and peritoneum, in the line of the skin incision

The incision is closed by (1) a continuous suture for the peritoneum and posterior sheath (2) With tissue-forceps on the inner edge of the displaced rectus, this muscle is drawn inward into its natural position, while a series of interrupted mass sutures are inserted, one and a half inches apart Each mass suture passes through the skin one inch to the right of the skin incision, through the anterior rectus sheath and rectus muscle It then picks up the sutured line of posterior sheath and peritoneum and, crossing the depth of the wound, enters the left rectus muscle enclosed in its sheath and emerges from the skin one inch to the left of the skin incision (3) The free (inner) edge of the displaced rectus muscle is attached by a continuous suture to the sheath of the opposite rectus (4) A continuous suture closes the incision in the anterior rectus sheath (5) The skin incision is closed with either Michel's clips or a continuous suture which may be either subcuticular

or through-and-through (6) The mass sutures are tied, *almost loosely*, the object of these sutures being, not to draw the parts together, but to prevent opening of the wound by severe and repeated straining or by increased intra-abdominal tension

The mass sutures are either stout silkworm gut or paragut (a substance resembling Japanese silk and practically unbreakable). All buried sutures are of catgut, hardened to last at least fourteen days For through-and-through skin suture, linen thread is employed

C HAMILTON WHITEFORD, M R C S

Plymouth, England

THE RED STIPLING SIGN OF GASTRIC AND DUODENAL ULCER

TO THE EDITOR OF THE ANNALS OF SURGERY

It is often difficult for the surgeon at the time of operation for chronic gastric and duodenal ulcer to determine whether the indurated mass felt in the stomach or duodenal wall is the induration of benign ulcer or whether it is the induration associated with the ulceration of malignant disease.

Any sign which helps to throw light upon this difficulty is important Since August, 1911, I have noticed that if the peritoneal surface over the ulcer base and its immediate vicinity is gently stroked with the rubber glove or with a bit of soft gauze sponge, almost immediately there is an appearance of little minute red points irregularly distributed over the area thus traumatized I have called this the red stippling There is no bleeding from this surface following light trauma

This local red stippling has been observed by me in cases of chronic ulcer of the duodenum and stomach Its occurrence has been noted by my associates in the surgical clinic so that the observation has been confirmed I simply place upon record and would call attention to this appearance that those having opportunity to determine its occurrence may assist further in interpreting its significance

This red stippling associated with chronic ulcer may be of considerable importance, possibly a helpful sign in determining ulcer from cancer It may be definitely characteristic of ulcer It is pretty constantly present

The accompanying drawing illustrates as well as can be shown in a drawing the appearance of this sign

Boston, Mass, April 6, 1914

CHARLES L SCUDDER

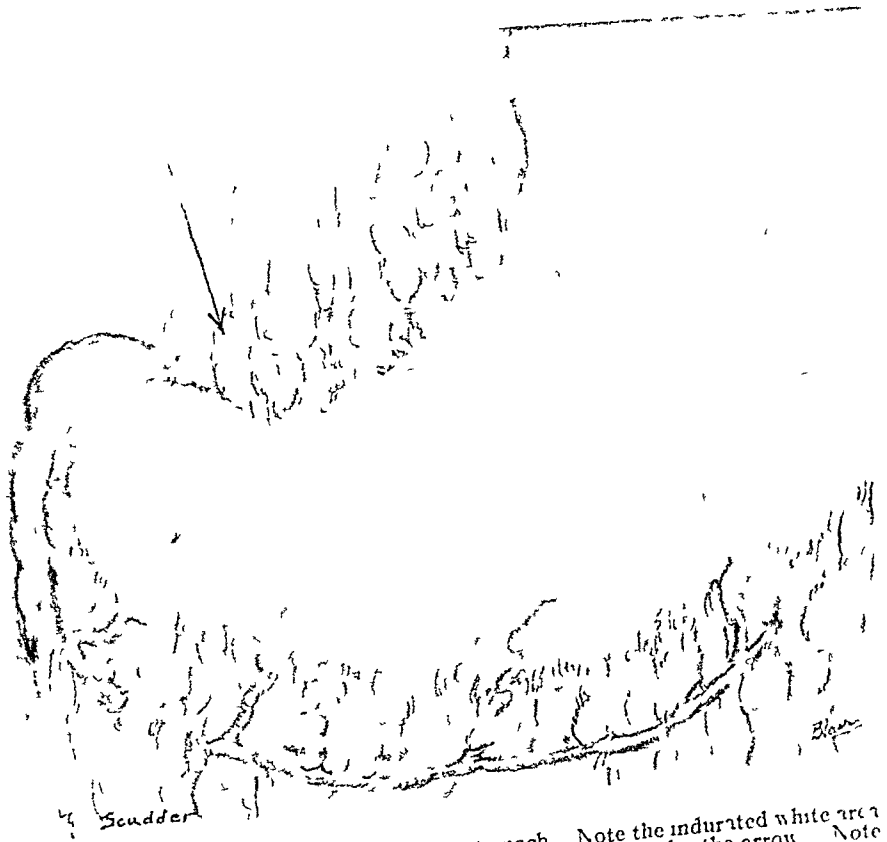


FIG 1 — 1 drawing of the pyloric end of the stomach. Note the indurated white area on the lesser curvature near the pylorus and in its centre pointed at by the arrow. Note the fine stippling occasioned by rubbing the peritoneal surface with gauze.

TREATMENT OF THORACIC ANEURISM WITH POTASSIUM IODIDE

EDITOR ANNALS OF SURGERY

Allow me to place on record now the following brief reference. The case was reported at the meeting of the New York Surgical Society of November 26, 1913 (*ANN SURG*, March, 1914, 462) and will be given in detail in the paper on the treatment of thoracic aneurism, which I read before the Society at that time.

The patient had been referred to me by Dr. C. D. Van Wagenen, who had shown the case just one year before at the Academy of Medicine, as one of left vocal cord paralysis due to aneurism of the aortic arch. Last September on examining the patient for the first time, he could find no physical signs indicating the presence of aneurism. A comparison of an X-ray picture taken in October, 1913, with one taken in June, 1912, at Bellevue Hospital by Dr. Hirsch, both at the same focus and in the same position, showed a shrinkage of from 1 to 1¼ inches in the transverse diameter of the aneurismal shadow to have taken place in the 16 months' time. A transverse X-ray of the thorax likewise showed at the present time a wide, clear space between the shadow of the aortic arch and the sternum. The patient had entirely recovered from his vocal cord paralysis in the spring of the present year. In the 16 months between the taking of the two X-rays he had had potassium iodide in 5 and 10 grain doses three times a day at intervals, for a total of about 23 weeks, besides 9 injections of salicylate of mercury gr. ss. He had also had some potassium iodide in small doses prior to this time.

WILLIAM C. LUSK, M.D.

New York, March 31, 1914.

AN EVACUATOR FOR THE REMOVAL, DURING OPERA- TION, OF FLUIDS FROM THE ABDOMINAL AND OTHER CAVITIES

EDITOR ANNALS OF SURGERY

Twelve years' experience of the below-described instrument having confirmed its usefulness, I beg to submit the following description.

In 1909, Kenyon and Pool described (*Surg., Gynec. and Obstet.*, December, 1909) an instrument made on similar principles, but of different form.

In 1911, Koch (Groningen) described (*Brit Med Journ*, October 28, 1911, p 1070) an evacuator almost identical with the following Pool has also recently described his instrument (*ANNALS OF SURGERY*, October, 1913, 537)

The evacuator, made at my request by a manufacturer of Leeds, consists of two hollow metal tubes, the size of a No 12 Silver Catheter, the tubes lying side by side, and united to each other for the greater part of their length Both tubes screw into a hollow metal globe, one inch in diameter, which is freely perforated everywhere except at its lower pole The longer tube, through which the fluid is sucked, reaches to within $\frac{1}{8}$ inch of the bottom of the globe The shorter tube penetrates only to the upper part of the globe, and connects the interior of the globe with the air and thus prevents a negative pressure within the globe, which might lead to bits of omentum or other soft tissues being sucked through the perforations The outer end of the shorter tube has a removable plug By inserting this plug and injecting lotion down the longer tube the instrument can be converted into an irrigator Six feet of stout walled rubber tubing connect the longer tube with the cork of a glass bottle, to which is also attached a shorter length of rubber tubing which, for use in a hospital, leads to a suction apparatus, similar to that employed by dentists, fitted to a water tap on the main For use in private, the suction apparatus is composed of a reversed enema syringe, which is worked by a nurse With the globe of the evacuator immersed in a pool of fluid, the fluid trickles through the perforations to the bottom of the bulb where it lies in contact with the end of the longer tube through which the fluid is sucked out

Plymouth, England

C HAMILTON WHITEFORD

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SOME PROBLEMS IN THE EARLY DIAGNOSIS AND TREATMENT OF SARCOMA OF THE LONG BONES *

BY WILLIAM B. COLEY, M D.

OF NEW YORK

PROFESSOR OF CLINICAL SURGERY, CORNELL UNIVERSITY MEDICAL SCHOOL, ATTENDING SURGEON TO THE GENERAL MEMORIAL HOSPITAL FOR THE TREATMENT OF CANCER AND ALLIED DISEASES, ATTENDING SURGEON TO THE HOSPITAL FOR RUPTURED AND CRIPPLED

FOR many years I have been especially interested in the study of sarcoma of the long bones, and have given considerable attention to the question of early diagnosis. Although much has been written on the subject during the last few years, there are still many important points unsettled, which must await the fuller knowledge derived from larger experience and more complete data.

By far the most illuminating discussion of this subject is that before the Royal Society of Medicine, in London, November, 1912. To this discussion Sir Alfred Pearce Gould, Sir Bland Sutton, Sir Frederick Eve, Mr G H Makins, and several other surgeons and pathologists of note contributed the results of their large experience and broad knowledge. In addition most important new data were presented by Mr G E Gask and Mr R C Maybury.

Mr. Gask reported the results of the treatment of sarcoma of the long bones observed at St Bartholomew's Hospital, from 1902 to 1911, a total of 61 cases, in carefully tabulated form, and Mr. Maybury gave a statistical report of long bone sarcoma cases at St Thomas's Hospital, from 1901-1911, amounting to 45 in all.

The distribution of the St Bartholomew cases is as follows:

	Male	Female	Total
Clavicle	0	2	2
Femur	18	7	25
Fibula	1	0	1
Humerus	7	1	8
Radius	2	0	2
Scapula	7	2	9
Tibia	10	4	14
Ulna	0	0	0

* Read before the American Surgical Association, April 8, 1914

I can call attention only in the briefest way to the results Of the femur cases, 25 in number, not a single patient with periosteal sarcoma was alive over three years after operation, and only one remained well eighteen months after Of the myeloid type, 4 in number, 2 remained well over three years Of the humerus cases, 8 in number, all were reported dead, not a single one reaching the three-year limit Of the 2 radius cases, one died and one remained well over three years The scapula cases were included in this list, although it seems to me hardly proper to do so, of these, 8 in all, one was well over 3 years, and the remainder had died Of the tibia cases, periosteal type, 11 in number, one was well over five years, and of the myeloid type (3), one remained well over three years In other words, of a total of 61 cases, only five passed the three-year limit, that is, 2 myeloid cases of the femur, 1 radius, and 2 tibia

As regards the St Thomas' Hospital statistics, there were 28 periosteal cases, and 17 myeloid Of the former, 11 were not traced, 14 had died, 1 was well two years after operation, and not a single case passed the three-year limit Of the 17 myeloid cases, without regard to the particular bone in which the disease originated, 8 were not traced, and of the remaining 9, 2 had died, and 5 remained well over three years The latter 5 cases were all of the giant-celled type, and were located as follows

- One femur, giant-celled, well 9 years after amputation of the thigh
- One femur, giant-celled, well $7\frac{1}{2}$ years after amputation of the thigh
- One femur, giant-celled, well $3\frac{1}{4}$ years after amputation of the thigh
- One femur, myeloid, well 3 years after operation.
- One tibia, giant-celled, well 6 years after operation

It is further worthy of note that not a single humerus case was cured by amputation Apparently resection had not been employed in either hospital, even for the giant-celled or myeloid type Grouping the statistics of the two hospitals together, of the 106 cases treated in both, only 10 had passed the three-year limit

SYNOPSIS OF TABLES (1902-1911)

<i>St Bartholomew's Hospital</i>		<i>Butlin's Collected Cases</i>	
Type	Well over 3 years	Type	Well over 3 years
Clavicle, 2	0	Clavicle, 7	0
Femur (periosteal), 21	0	Femur (periosteal), 68	1
Femur (myeloid), 5	3	Femur (myeloid), 46	5
Humerus (periosteal), 8	0	Humerus	0
Radius (myeloid), 2	1	Radius and ulna (myeloid), 16	6
Scapula (periosteal), 9	1	Scapula (periosteal), 25	1
Tibia (periosteal), 11	1	Tibia (periosteal), 35	1
Tibia (myeloid), 3	1	Tibia (myeloid), 52	9

The study of these interesting groups of cases treated at two of the leading hospitals in England shows that, with all the aids in recent years for reaching an early diagnosis, there is but little improvement over the gloomy statistics of Butlin a generation ago, the prognosis in periosteal sarcoma being practically hopeless in both series

In conjunction with these cases, I would submit a brief analysis of my own cases, the results of which are considerably better than

SARCOMA OF THE LONG BONES

those quoted above This fact I am certain is not due to earlier diagnosis, as many of the cases were far advanced and inoperable when they were referred to me, but I believe the cause of the improvement must be looked for in the difference in the methods of treatment This difference has consisted in the use of the mixed toxins of erysipelas and bacillus prodigiosus in a certain number of cases before amputation in the hope of saving the limb, and in other cases, immediately after amputation in the hope of preventing a recurrence

PERSONAL CASES

Femur	60
Tibia	20
Fibula	5
Humerus	20
Radius	6
Ulna	4
Clavicle	6
Metacarpal	2
Metatarsal	1
	<hr/>
Total	124

A RÉSUMÉ OF FINAL RESULTS

Inasmuch as my cases have been published more or less in detail in previous papers,¹ I shall at present give only a brief résumé of the successful cases

CASE I—*Spindle-celled sarcoma of tibia, periosteal* W F, male, age twenty-seven years, amputation had been advised Entire disappearance of the tumor under four months' treatment with mixed toxins Patient in good health to-day, sixteen years later, with perfectly normal limb He was presented before the International Congress of Surgeons, at the General Memorial Hospital, on April 10, 1914

CASE II—*Periosteal round-celled sarcoma of the femur, involving two-thirds of the shaft, extensive metastases in the pectoral region* A G, male, nineteen years of age Hip-joint amputation had been advised, but refused by the patient Entire disappearance of the disease under two months' toxin treatment The patient remained well for ten years, when he developed a very highly malignant tumor—sarcoma and epithelioma—at the site of an old X-ray burn in the skin of the thigh, which proved rapidly fatal This case was reported fully in the *ANNALS OF SURGERY*, July, 1913, and *Trans Am Surg Assn*, 1913

¹ Sarcoma of the Long Bones, with Report of 68 Cases, *ANNALS OF SURGERY*, March, 1907, A Plea for more Conservative Treatment of Sarcoma of the Long Bones, *Journal of the American Med Assn*, January 29 1910 Le traitement conservatif de sarcoma des os longs, *Extrait des Comptes Rendus du 24 Congres de l'Assn Francaise de Chir*, 1911

CASE III—*Sarcoma of the upper end of the femur, round-celled, giant-celled* R L, female, eighteen years of age Spontaneous fracture, too far advanced for hip-joint amputation Recovery under the mixed toxin treatment, patient in good health with sound limb, eight years later

CASE IV—*Sarcoma of the humerus, upper end, round-celled, central, with involvement of glenoid cavity* A C, female, thirty-one years of age Too far advanced for shoulder-joint amputation Incomplete operation, curetting, followed by prolonged toxin treatment, carried out by Dr J B Blake, of Boston, under my direction Patient well 14 years later

CASE V—*Sarcoma of the tibia, central, involving periosteum* K K, female, seventeen years of age Rapid recurrence had followed three conservative operations Under six months' treatment with the mixed toxins, combined with a short period of X-ray treatment, the patient entirely recovered without loss of leg She is in good health at present, nine years later She was shown by me at the General Memorial Hospital, before the International Congress of Surgery, April 10, 1914

CASE VI—*Periosteal round-celled sarcoma of the femur* Male, fifty-eight years old (Dr Williamson's case) Considered too far advanced for hip-joint amputation by Dr Wm J Mayo, of Rochester, Minn, who advised the mixed toxin treatment, which was carried out by Dr Williamson, of Grand Forks, N D, under my direction Entire disappearance, limb saved, patient perfectly well at present, five years later Microscopical examination made at the State Laboratory of North Dakota

CASE VII—*Sarcoma of femur, central, not giant-celled, involving periosteum* J P W, male, thirty-five years of age Amputation below trochanter by Dr Erdmann, toxins given for four months after operation Patient well at present, nine years later

CASE VIII—*Sarcoma of the lower end of the femur, mixed-celled, involving periosteum* S D, female, eighteen years old Amputation below trochanter, followed by five months' toxin treatment Patient in good health when last observed, six years later

CASE IX—*Sarcoma of radius, periosteal, pathologic fracture* L M L, female, thirty-one years of age Amputation, toxins for three months after operation, well at present, six years later

CASE X—*Sarcoma of the radius, central origin, giant-celled, pathologic fracture* M F, female, twenty-six years of age Amputation advised by two surgeons, refused by patient, curettage followed by toxins for six months, disappearance of tumor; patient well at present, six years later

CASE XI—*Sarcoma of femur, periosteal* C L, female, aged thirteen years Toxins for four months after operation, patient remained well for three years, then developed pulmonary metastases, causing death six months later

CASE XII—*Sarcoma of the lower end of the radius, round-celled, rapid growth, pathologic fracture* F S, female, aged twenty-five years Curettage, followed by toxins for six weeks Entire disappearance of the tumor, patient well when last heard from, two years later

CASE XIII—*Sarcoma of femur, central origin, mixed round- and*

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spindle-celled, involving entire lower end of femur Amputation, toxins for nearly a year after amputation Patient in good health at present, nearly six years later

CASE XIV—*Sarcoma of ulna, round-celled* I, male, fifteen years old (Case of Dr Robt W Lovett, of Boston) Toxins given for four months after amputation of arm, patient in good health four years later

CASE XV—*Sarcoma of femur, round-celled, periosteal* (Case of Dr Willmuth, of Louisville, Ky) Almost complete disappearance of tumor under the toxins treatment, restoration of health, patient well when last observed, 18 months after treatment, which was carried out by Dr Willmuth, under my direction

CASE XVI—*Sarcoma of clavicle, round-celled, periosteal* Very rapid growth, total excision of clavicle, followed by toxins for four months, patient remained well five years

CASE XVII—*Sarcoma of clavicle, round-celled, periosteal* Total excision, toxins given for a period of eight months Patient well at present, six years later

CASE XVIII—*Sarcoma of humerus, periosteal, round-celled, metastatic, after amputation of leg for tibial sarcoma* R G H, male, forty-six years Amputation of shoulder-joint by Dr Brackett, of Boston, followed by toxin treatment for four months He remained well for two years, then developed metastases in the spine, for which a laminectomy was done, which he did not survive

CASE XIX—*Sarcoma of the metatarsal bone, periosteal, small, round-celled, of rapid growth.* F K., female, sixteen years Amputation of lower third of leg, toxins for six months Patient well when last heard from ten years later.

CASE XX—*Sarcoma of femur, periosteal, round-celled, involving upper third of shaft of leg* C M, male, thirty-five years Rapid growth Toxins given for four months, and while the growth was checked, the tumor did not disappear Amputation at the hip-joint later performed by another surgeon Patient well when last heard from one year after amputation

CASE XXI—*Sarcoma of lower end of femur, round-celled, of central origin, involving the popliteal space* A J McC, male, forty-one years Toxins administered for eight months, with decrease in size of tumor, improvement in function of leg, and general condition of patient He then developed an infection of the sinus, resulting from exploratory incision, necessitating immediate amputation Patient is well at present, over three years later

CASE XXII—*Round-celled sarcoma of lower end of femur, involving the popliteal space, central origin* C H S, male, forty-seven years Toxins given for nine months with decrease in size of tumor, and improvement in patient's general health He then had a sudden hemorrhage resulting from a ruptured blood-vessel, necessitating immediate amputation Patient recovered and is still well three years later

CASE XXIII—*Sarcoma of fibula, periosteal* M F, female, thirty-eight years Toxins for several weeks before amputation, no appreciable

effect, therefore amputation followed by toxin treatment Patient well at present, two years later

CASE XXIV—*Periosteal sarcoma of right femur* G. M, female, twenty-seven years Amputation advised but refused by patient Tumor practically disappeared under six weeks' toxin treatment Patient returned home and tumor again increased in size Under larger doses and prolonged treatment, the disease was finally controlled, and the patient is well at present, two years later

CASE XXV—*Spindle-celled sarcoma of humerus, periosteal, rapid growth, pathological fracture, believed to be entirely beyond amputation* F L, male, thirty-five years Apparent complete disappearance under five months' toxin treatment, firm reunion of arm Recurrence necessitating shoulder-joint amputation Later again followed by recurrence in pectoral muscle Partial operation followed by toxin treatment Patient in good health to-day, four years later

CASE XXVI—*Sarcoma of upper end of tibia, central* C M R, female, sixteen years Conservative operation followed by prolonged toxin treatment Patient in perfect health four years later

CASE XXVII—*Very large myrosarcoma, chondrosarcoma of femur, periosteal* H P, male, twenty-seven years Amputation at the hip-joint followed by three months' toxin treatment. Patient in excellent health to-day, two years later

CASES IN WHICH TOXINS WERE NOT USED

CASE XXVIII—*Myeloid, round-celled, giant-celled sarcoma of lower third of radius* C H, female, twenty-nine years Two conservative operations by Dr Hibbs, first in 1900, second January, 1902, amputation advised by several surgeons but refused, patient well when last heard from eight years later

CASE XXIX—*Sarcoma of tibia, upper end, central origin* S L, female, twenty-four years Amputation below lower third of thigh Patient well when last heard from ten years later

CASE XXX—*Sarcoma of upper end of tibia, giant-celled, central origin* E W, female, twenty-six years Amputation by Dr Bull below third of thigh Patient well seven years when metastasis occurred in the lung Death six months thereafter

CASE XXXI—*Sarcoma of lower end of femur, central, giant-celled* C C S, male, forty-two years Amputation advised but refused Cured Patient in good health two years later without recurrence

The limb was saved by the preliminary use of toxins in 11 cases I cannot, therefore, too strongly urge such preliminary toxin treatment The few weeks needed to determine the question as to whether the toxins will be of value in the given case is not connected with any appreciable risk, and if it is possible to save the limb in such a considerable number of cases, it is certainly worth this trial, even if the toxins fail to completely control the tumor and it is found necessary subsequently to resort to amputation, the preliminary use of the

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toxins has unquestionably had a modifying effect upon the malignancy of the tumor, in a number of cases at least, as shown by one of my own cases, a very far advanced periosteal sarcoma involving the middle and upper thirds of the femur,—which I regarded beyond hip-joint amputation. At the end of four months' treatment the growth had been practically entirely inhibited, spontaneous fracture followed and the leg was later amputated at the hip-joint by another surgeon. The patient was well 1½ years later, when last heard from. The case of Sir Frederick Eve is another case in point.

The foregoing summary shows 27 cases in which the toxins were used either before or after amputation or both.

Femur cases, 13, well from 1½ to 10 years, or 10 from 3-10 years. Eight of these were of periosteal origin, 5 of central (of the latter, 2 involved the periosteum).

Tibia cases, 3, well 4, 9 and 16 years respectively, of which 2 were of central, and 1 of periosteal origin. All of them were cured by a conservative operation followed by the toxins.

Radius cases, 3, of which 2 remained well six years, the other, 2 years. Two were of central, and one of periosteal origin. Two of the cases were cured by curettage followed by toxin treatment, in one the toxins were used after amputation.

Humerus cases, 3, two were of periosteal origin, and 1 of central. In one of these cases the arm was saved, the toxins being given after an incomplete operation. The patient remained well 14 years later. In the other two cases amputation had to be done, and they have remained well, 4 and 3 years respectively. The latter case finally had a recurrence in spine and died as the result of operation.

Ulna cases, 1, of periosteal origin. This patient received a course of toxin treatment after amputation of the arm, and has remained well for six years.

Fibula cases, 1, of periosteal origin. Amputation was done 2 years ago, followed by toxin treatment. Patient is well at present, two years later.

Metatarsal bone, 1, case of periosteal origin. The toxins were used as a prophylactic after amputation, and the patient was well when last heard from, ten years later.

Clavicle cases, 2, both of periosteal origin. In both cases, total excision was done, followed by a course of toxin treatment. One remained well five years, the other is still well and free from recurrence at present, 6 years later.

Twenty-one of the foregoing cases remained well from 3-16 years, 14 cases remained well from 5-11 years.

In 11 of the above 27 cases, the limb was saved by the use of the toxins, and 8 of these remained well from 3-16 years.

In 16 of the cases, the toxins were used as a prophylactic and in 5 of these they had been given before amputation as well.

It is important to note that my own series of cases differs from every other published series of cases, in that it represents a much larger num-

ber of advanced cases, in which the disease had progressed so far that the condition was inoperable and apparently practically hopeless at the time the patients came under my observation

Diagnosis—The early diagnosis of sarcoma of the long bones requires accurate clinical knowledge of all the conditions most likely to simulate sarcoma. Second, it requires a great amount of actual examination and careful clinical study of a large number of cases of sarcoma of the long bones. The tactile sense may be so educated by such experience that it has an inestimable value in making a diagnosis. A careful history of the case brings out important facts which long experience, combined with good judgment, will arrange in logical order, and give proper weight in arriving at the final diagnosis.

Clinical Diagnosis—In a considerable proportion of my own cases, pain has been the first symptom of the disease, preceding the development of the tumor. Pain may vary in character, but it is usually a deep-seated, boring pain, worse at night, or after using the limb. After a tumor has developed to sufficient size to be palpable, there is generally the sign of local heat and in not a few instances there may be a general rise of temperature, up to $101-102^{\circ}$. One of my own cases, a boy of twelve, with a fusiform swelling in the middle of the femur, showed a daily rise of temperature to $100-101-101\frac{1}{2}^{\circ}$. This, with the local heat, caused the patient to be admitted on the diagnosis of periostitis. I made the diagnosis of periosteal sarcoma, which was confirmed by microscopical examination.

The locality of the tumor may be of considerable help in the diagnosis, particularly when making a differential diagnosis between sarcoma and tuberculosis. Sarcoma very rarely, in the early stages at least, involves the joint or synovial membrane. It may be differentiated from an exostosis or osteoma, by the fact that the latter is of slower growth, is usually without pain, is harder and more uniform as to consistence, and is very apt to be pedunculated.

Sir Alfred Pearce Gould attaches great importance to the globular expansion of the long bone, holding that

"True expansion of the bone is a sign of the greatest importance, and the more limited the area of bone expanded, and the greater the degree of expansion, the more characteristic this sign, and the more likely is the tumor to be a myeloma rather than a sarcoma. The absence of new bone laid down on the surface of the enlarging bone is a striking distinction between a sarcomatous growth and a tuberculous, syphilitic, or inflammatory osteitis.

"I have already pointed out that in the case of central sarcoma in the earliest stage, only the X-ray can demonstrate its presence. But the increasing growth of a sarcoma is attended with other features that enable us to identify

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it In myeloma particularly we notice the globular outline of the tumor and its expansion of the bone into a similar globular form In no other disease is the globular expansion of an epiphysis carried to such a degree, the swelling shows no tendency to extend along the shaft, and to involve more and more of the length of the bone The cancellous bone is rapidly destroyed, and the outer shell of bone is truly expanded there is no real thickening of the bone from new deposit on its outer surface This is a striking contrast to the condition found in tuberculous or coccal infection of an epiphysis"

Sir Frederick Eve has advanced a theory which is original as far as I know He asserts that the difference in the nature of myeloma and sarcoma depends rather upon the site of the disease than upon the structure of the tumor, the nearer the body, the greater the degree of malignancy would appear to be true of the myelomata as well as the periosteal sarcomata

My own experience has not been in entire accord with this theory One of the most malignant tumors that I have ever seen was a periosteal sarcoma of the metacarpal bone, and another a sarcoma of the lower end of the ulna

Sir Frederick Eve further states that

"Although it has long been taught that the true myeloma has a low degree of malignancy, yet it is only in recent years that it has been recognized as possessing, at least in some situations, a purely local malignancy. Butlin, even in 1900, classed the central round and spindle-celled sarcomas with the myelomata under the common heading of central tumors, in discussing their treatment. The broad general statement made in some text-books that the myelomata are only locally malignant required, however, considerable modification The myelomata of the femur, and especially those of the upper end of the humerus, are sometimes followed by metastasis According to Butlin's statistics, the tumors were giant-celled sarcoma in three out of five patients who died with metastasis after amputation of the femur for central sarcoma And in two out of three unsuccessful cases of sarcoma of the upper end of the humerus two were described as myeloid sarcoma"

The question of the relative malignancy of myeloid sarcoma is one that is still far from settled The opinion held by Bloodgood and others is that giant-celled sarcomas are practically benign, and furthermore, that they never give rise to metastasis It is evident that the different writers who took part in the Royal Society of Medicine discussion of this question, approached it from different points of view Some include in this type of myeloid sarcoma, all endosteal sarcomas, some of which latter are of high malignancy, while others limit the term to small encapsulated endosteal tumors of slow growth, made up almost entirely of giant-cells

I agree with Mr Gilbert Scott, of London, who, in the discussion,

stated that although myeloid sarcomas are usually of slow growth, they may also be just as rapid in growth, and as fatal, as true endosteal sarcoma. At any rate, in my own personal experience in a number of cases in which the pathologist's report stated that it was a giant-celled tumor of the epulis type, the disease ran a clinical course of extreme malignancy, causing the death of the patient within a few months and often associated with metastasis. Histologically there is apparently no difference between this type of tumor and the slow-growing epulis of the jaw.

With regard to the question as to whether these myeloid or giant-celled endosteal tumors ever produce metastasis, opposite opinions are held. Maybury cites two cases of myeloid sarcoma, observed at St Thomas' Hospital, in both of which the patient died of small deposits in the lung. Case I. Girl, sixteen years of age, with sarcoma of the femur of three months' duration, exploratory operation and microscopical examination. Amputation done, metastasis of the lung 7 months later, causing death. Case II. Disease occurred in the bone, amputation, metastasis of lung, death eight months later. Slides of both of these cases were presented at the discussion of the Royal Society of Medicine and were pronounced typical specimens of giant-celled sarcoma.

Following are the results of the 4 cases of sarcoma of cartilage, treated at St Thomas' Hospital. 1 not traced, 1 died $2\frac{1}{2}$ years after operation, 1 died 5 years after operation, 1 alive 2 years and 7 months after operation.

My own cases strongly support the view held by Mr Maybury, on the subject.

The following personal case I believe to be worthy of a detailed report, inasmuch as it has an important bearing upon the question of the malignancy of myeloid or giant-celled tumors, about which there is such great difference of opinion here and abroad.

Sarcoma of the Humerus—H. B., male, ten years of age, was referred to me on March 16, 1910, by Dr Bellis, of Trenton, N. J., with the following history. Had a fall upon the ice five weeks before, striking upon his left shoulder and upper arm. He could not use the arm after the fall and was seen by a physician who found loss of power and evidence of fracture at the junction of middle and upper third of humerus. He was put in a plaster case. Three weeks later, or two weeks before I saw him, on removal of the splint, a tumor of considerable size was found at the point of fracture. This was regarded at first as redundant callus. It was watched for a week, at the end of which time it had markedly increased in size. The patient was then seen by Dr Bellis, who found a large tumor

FIG 1—H B Sarcoma of humerus periosteal Interscapulothoracic amputation Duration of
only five weeks duration



FIG 2 —H B Sarcoma of humerus Microscopic examination giant-celled epulis type Death from lung metastasis in one year

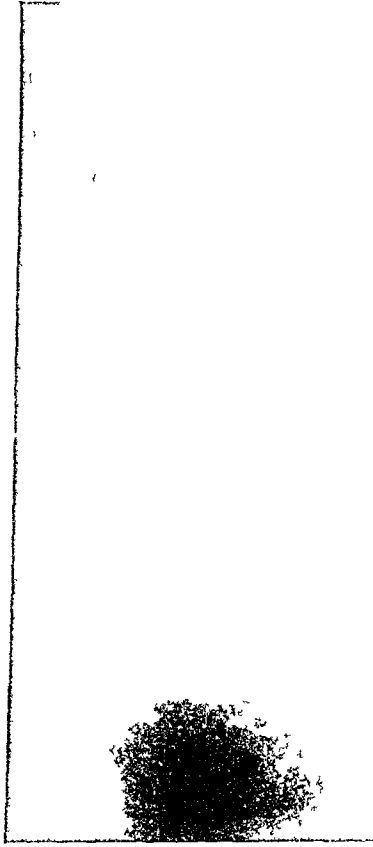


FIG 3 —R Γ Sarcoma of humerus periosteal



FIG 4—R F Microscopic report malignant osteoid medullary giant celled sarcoma of humerus, very Metastasis shortly after amputation

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in the upper third of the humerus, enlarged veins, having the typical appearance of a sarcoma. The tumor increased rapidly in size and a week later, March 16, 1910, Dr Bellis referred the patient to me. Physical examination at this time shows the left humerus enormously enlarged, measurements being $12\frac{5}{8}$, $13\frac{7}{8}$ and $14\frac{1}{2}$ against $7\frac{3}{8}$, 10 and $11\frac{1}{2}$ inches on the opposite side. All superficial veins were greatly enlarged and bluish in appearance. The tumor extended beneath the pectoral muscle to the middle of the clavicle, and posteriorly to the edge of the scapula. Some glands could be felt in the axilla. There was very little loss of weight. The X-ray showed what I believed to be the typical appearance of sarcoma. Without waiting for a pathological confirmation of the diagnosis which seemed to be perfectly clear, and in view of the apparent high degree of malignancy of the disease as evidenced by its rapid growth, I believed it unsafe and unwise to do an exploratory operation, and determined to amputate at once, which I did at the shoulder-joint. The patient made a satisfactory recovery from the operation and was put upon small doses of the mixed toxins, which were continued twice a week by his local physician for about two months, then once a week for another two months. The report of the microscopical examination made by Dr Jas Ewing, Professor of Pathology at Cornell University, reads as follows:

(March 21, 1910) "The process in the humerus proves to belong in the class of giant-celled sarcoma. It consists of wide blood-space surrounded by thin strands of loose cellular tissue composed of spindle-cells. The spaces are partly lined by giant-cells and some few giant-cells are found within the strands of tumor tissue. By far the larger part of the bulk of the tumor is made up of blood spaces. The tumor has exactly the structure of the giant-cell epulis, and I think, therefore, that it has the same moderate degree of malignancy."

From the histological appearance of the tumor, Dr Ewing was so impressed with its low grade of malignancy, that he believed that I had been in error in doing such a radical operation, since he had seen a similar case which had been cured by curetting.

The subsequent history of the case is of interest.

December 26, 1910, Dr Young writes "The boy is in excellent health, and shows no sign of any trouble."

May 31, 1911, I examined the patient personally and found he had a slight cough, no loss of weight and no physical signs of a recurrence. Soon after he began to show great lassitude, general malaise and less ability to bear exercise.

June 30, 1911, physical examination by myself showed very marked dulness in the right apex, shortness of breath, slight hacking cough.

The clinical signs in the chest increased, the patient's general condition rapidly deteriorated and he died on August 20, 1911, fifteen months after the operation.

It is but fair to say that on later examination of the specimen by Dr Ewing, he inclined to the belief that the tumor in question belonged to the rare type of bone aneurism of a very high degree of malignancy, rather than to the epulis or giant-cell type.

If this be true, it only goes to show that the two types of tumor may so closely resemble each other that the most expert pathologists with the widest experience are not always able to distinguish them

In connection with the generally supposed benign character of giant-celled sarcoma, I would further mention the following case observed at the General Memorial Hospital two years ago, on the service of Dr Chas N Dowd

Male, twelve years of age Tumor of the lower jaw. Microscopical examination showed it to be a myeloid sarcoma of the epulis type, supposed to be of very benign character In spite of operation, it recurred promptly and grew with great rapidity, causing death within four months.

I had a very similar case four years ago, of a tumor occurring in a young woman eighteen years of age Patient went to the Thirty-third Street Hospital, where, under ether anæsthesia, Dr Downes and I removed a large portion of the tumor, which was easily extirpated by curette and large spoon Microscopical examination was made by Dr James Ewing, who pronounced the disease myeloid sarcoma of the epulis type The patient was put upon the mixed toxins, but the tumor grew so rapidly that it was thought inadvisable to continue the treatment. The patient steadily grew worse and died about a month later In this case the total duration of life was four months from the time the tumor was first noticed

Sarcoma of Right Humerus—Very highly malignant yet microscopically of the epulis type R F, fourteen years of age, no history of tuberculosis or cancer in family Patient had always been in good health until June, 1911, when she noticed pain in the upper part of the left shoulder, followed shortly by noticeable enlargement, the swelling increased in size and the pain continued She was brought to me by her family physician, Dr L I Mason, of Willimantic, Conn, on September 21, 1911 From the clinical appearance of the tumor combined with the X-ray, I made the diagnosis of periosteal sarcoma Without any exploratory operation, I decided upon immediate amputation, which was done on August 23 at the General Memorial Hospital The tumor was examined by both Dr W E Clark, pathologist at the General Memorial Hospital, and by Dr Jas Ewing, professor of pathology at Cornell University Medical School

The former reported

"Biceps tendon undergoing degeneration, edge of specimen contains small amount of tumor tissue"

Dr Ewing's report reads

"The tumor is a mixed type of giant- and spindle-cells of the epulis variety"

The mixed toxins were begun on September 6, the injections being made in the pectoral region She received four treatments while in the hospital, the largest dose being 2 minims which was followed by a chill and temperature of 101° On October 16, went home to have the treatment continued, but her condition grew worse so rapidly only two

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small doses were given. On September 25, Dr. Mason noticed a slight recurrence. The wound had not yet entirely healed and there was a recurrent mass, half an inch in diameter, appearing in the scar. This increased rapidly in size despite the toxin treatment which had been resumed. The patient's general condition markedly deteriorated and the toxins were discontinued. The recurrent tumor grew with phenomenal rapidity and the patient died on October 28, a little over two months after amputation, or three months after the first signs of the disease were noticed.

The X-Ray in Diagnosis—While the X-ray may often be misleading in the early stage of sarcoma of the long bones, it may also be of valuable help in making an early diagnosis. In order properly to estimate its value, large experience in interpreting X-ray photographs is required. In periosteal sarcoma we may have lesions that closely simulate sarcoma, especially in the non-ossifying type, in which no new bone is developed, the old bone being eroded or partially destroyed. Tuberculosis, syphilis, and chronic osteitis may simulate this condition. The X-ray is of very great help in such cases. Here we have a tendency of new bone to form spicules which stand out or radiate at right angles to the shaft of the bone, and in the opinion of many authorities, this particular arrangement is characteristic of sarcoma. I would not go quite so far as to endorse this, as there are important exceptions to this rule, *e.g.*, Appel case.

The X-ray shows little or no difference between a sarcoma of the shaft of the bone and a carcinoma of the bone secondary to primary carcinoma elsewhere in the body. The clinical history should settle this point. In endosteal tumors, the X-ray may not enable one to differentiate between a bone cyst and a central sarcoma, but the clinical history may often help to make a differential diagnosis.

The following case shows that the sharply defined periosteal line, which can usually be relied upon as an important diagnostic sign in the differential diagnosis between myositis ossificans and periosteal sarcoma, occasionally fails.

H. W., female, eighteen years old, entered my service at the General Memorial Hospital, in June, 1910, with the following history:

She had noticed pain or a drawing sensation at the junction of the middle and lower thirds of the right thigh for 3-4 weeks. The pain gradually increased and a little later a swelling could be detected in this region. There was no history of injury. Physical examination showed a fusiform enlargement at the junction of middle and lower thirds of right thigh apparently connected with the bone, of moderately hard consistence and not tender. The skin was slightly reddened from external applications which had been made at one of the large surgical clinics for two weeks, on the supposition that the trouble was of inflammatory character. I had an

X-ray photograph taken which showed a slight fusiform enlargement in the lower third of the femur and a clearly defined, apparently normal periosteal line, quite as well defined as one sees in myositis ossificans, with none of the indentations or erosions so characteristic of sarcoma of the femur in its early stages. In the absence of any previous injury, I made the diagnosis of sarcoma of the femur, which was confirmed by microscopical examination of a portion of the tumor removed by exploratory operation. The patient refused amputation as well as further toxin treatment. Later history of the case unknown.

The following two cases, for the histories of which I am indebted to my colleague, Dr Wm A Downes, show the importance of repeated or serial X-ray examinations in the early stages, when the diagnosis is in doubt.

CASE I—A G, male, thirty-six years of age, admitted to St Luke's Hospital on July 18, 1913. Family history, negative, personal history. Seven months before, patient had fallen upon his hip. He returned to work after a few days, although he had local pain, which was attributed to rheumatism. He consulted the Out-patient Department of St Luke's Hospital, and was told that he had hip trouble. A month before his admission to St Luke's Hospital, he had stayed at the J Hood Wright Hospital for seven days, where the diagnosis of tuberculous hip-joint was made. During the entire time the patient had severe pains, starting in the hip and radiating down the leg. These pains were more severe at night. The first X-ray plate taken at St Luke's Hospital, shortly after his admission, on July 18, 1913, showed nothing characteristic of sarcoma, one taken later showed distinct changes in the outline of the bone and evidence of new growths. At this time an exploratory operation was done and the pathological diagnosis of fibrosarcoma of the femur made. The disease was then too extensive for hip-joint amputation. The tumor grew very rapidly and the patient died.

CASE II—*Central sarcoma of lower end of femur and popliteal region*. S F, female, sixteen years, admitted to St Luke's Hospital on August 28, 1913, discharged December 5, 1913. Tuberculosis in family. Personal history. Two months before admission the patient noticed a slight stiffness about the knee, which gradually increased and was accompanied by some swelling, walking became more and more difficult, no redness about the joint, although at times there was some tenderness and local heat. No history of antecedent trauma, except that her foot was hurt in an elevator 1½ years before. The first X-ray plate taken showed practically nothing abnormal. Three weeks later, a second X-ray taken in the same position showed a distinct enlargement, very characteristic of sarcoma. Dr Downes then immediately amputated at the hip-joint. The patient is well at the present time.

The difficulty in making an early diagnosis in many cases of sarcoma of the long bones is illustrated by the following case

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Sarcoma of Humerus—S E, twenty-three years of age, male, was thrown from a horse in July, 1912, sustaining abrasions on the face and right elbow, and a severe shaking up. In the latter part of August he noticed pain in the right shoulder, directly over the head of the humerus and acromion process of the scapula. X-ray examination proved negative. He showed some improvement under local application of heat. In October, another X-ray was taken and showed a rarefying osteitis. The trouble was regarded by the attending physicians and consultants as probably a tuberculous joint. One month later he began to have attacks of indigestion, at the same time the shoulder became tender and somewhat swollen. The patient was examined by prominent specialists in orthopaedic surgery and internal medicine, but no diagnosis could be made until the middle of December, 1912, when an enlarged gland appeared beneath the pectoral muscle near the head of the humerus. This was removed and pronounced round-celled sarcoma at the Bender and Harvard laboratories. The patient's general condition rapidly deteriorated, he became greatly emaciated and suffered very severe pain. The toxins were begun on December 20 and continued for two weeks, at the end of which time I saw him in consultation. I found him in such an extremely emaciated condition, with such a weak, rapid pulse, that I advised against further treatment. He died a few weeks later. At the time of my examination there was a large tumor of the upper end of the humerus, apparently involving the entire circumference of the humerus with probable extension into the scapula.

In this case, though the patient had the advantage of very early X-ray examinations and consultation with leading specialists in surgery and medicine, no diagnosis was made until metastases had occurred and the patient was far beyond help. In this case and in many others I suspect we do not lay sufficient stress upon persistent, severe and localized pain.

In a very considerable number of my cases this kind of pain has been a pronounced feature in the earlier stages of the disease yet it has merely served to render the diagnosis of rheumatism acceptable to the patient and his friends and has not aroused the suspicion it should that the trouble in question might be sarcoma.

EXPLORATORY OPERATION AND MICROSCOPICAL EXAMINATION OF SPECIMEN REMOVED* ADVANTAGES AND DISADVANTAGES

Advantages—That the removal of a portion of a tumor and the report upon its histological structure by a competent pathologist is of the greatest advantage cannot be questioned, and under ordinary conditions, I believe, we should avail ourselves of this aid.

Disadvantages—There are, however, very definite and weighty objections to the exploratory operation in sarcoma of the long bones

which, in the opinion of many very high authorities, notably Mr. Ballance and Mr Makins, of London, may equal or exceed its advantages

a There is the danger that the mere cutting into the tumor, particularly a vascular round-celled sarcoma, may set free tumor cells which, entering the circulation, become carried to remote parts of the body, and give rise to early metastases. A number of cases have been cited, that furnish convincing evidence that such a result has occasionally followed exploratory operation

b There is the objection that the exploratory operation may do permanent damage in the way of causing sinuses that do not heal and which may become infected and later give rise to serious conditions, as seen in two of my own cases

c The last, but by no means least important, disadvantage is the risk that the exploratory incision, by reason either of not having been carried deeply enough, or by not happening to include a sufficiently characteristic portion of the tumor, necessarily leads to a negative report from the pathologist. With such a negative report on the one hand, yet with the clinical and X-ray data, on the other hand, strongly pointing to sarcoma, the surgeon is placed in a very difficult position

While many surgeons advise exploratory operation as a routine measure in all cases of sarcoma of the long bones and others are so impressed with its disadvantages and risk that they seldom or never resort to it, my own experience has led me to adopt a middle ground, which may be briefly stated as follows:

In cases in which the history and clinical signs are very strongly positive, I would not subject the patient to the risk of an exploratory operation, but would proceed immediately to perform the operation which seems best adapted to the individual case. I have on two occasions performed total excision of the clavicle for a rapidly growing periosteal tumor of only three weeks' duration. In both cases the clinical appearance of the tumor, confirmed by the X-ray picture, together with a history of the tumor having appeared almost immediately after an injury, made the clinical diagnosis so strongly positive, that it seemed unwise to submit the patient to the risk of exploration

Another case which I recall was that of a very large tumor of the upper end of the humerus, immediately following a fracture. The tumor had attained this large size in the short period of three weeks. It was associated with enlarged veins, and the X-ray gave a typical picture of sarcoma. I believed that cutting into such a vascular tumor

as this for the sake of verifying the diagnosis which seemed practically certain without such evidence, was unjustifiable. It might be urged, on the other hand, that in such cases an examination of a frozen section should be made at the time of operation, before any radical operation was performed.

To this I would reply that, in my opinion, the clinical history of the case and the macroscopical appearance of the tumor to one who has had a large experience in sarcoma, is of much greater value than the microscopical examination made from a frozen section. In the humerus case which I have just cited, the examination from the frozen section or exploratory operation would have been a distinct disadvantage, for the pathological report made on the basis of an examination of the entire tumor, pronounced it giant-celled sarcoma of the epulis type, and the pathologist stated that he believed amputation was not indicated, and that the disease could have been cured by curetting alone. Having nothing but the clinical evidence to go by, I did a shoulder-joint amputation. The patient made a good recovery, but in spite of a brief period of toxin treatment following the operation, within nine months, extensive metastasis occurred in the lungs and the patient died a few months later.

Furthermore, I would not make use of an exploratory operation in another group of cases, in which, though the clinical evidence is less strong and positive than in the preceding group of cases, the anatomical location of the tumor is such as to render probable a hemorrhage that might be difficult to control, or an even greater probability of a resulting sinus, difficult or impossible to heal. I would never again explore a probably sarcomatous tumor located in the lower end of the femur, situated behind the popliteal space, as I did in two cases already reported (*ANNALS OF SURGERY*, March, 1913, *Myositis Ossificans*).

My experience in the two cases which I have cited has convinced me of the disadvantages of exploratory operation in such cases. The better plan in this group of cases in my opinion would be to assume the diagnosis of sarcoma to be correct, in the absence of tubercular signs and with a negative Wassermann reaction, and to give the patient a brief course of treatment with the mixed toxins. During this treatment the clinical signs and measurements should be confirmed by a series of X-ray pictures taken at short intervals, *et cetera*, every 2-3 weeks. If it becomes evident that the disease is progressing, one can then resort to an operation, not merely an exploration but such an operation as seems best adapted to the particular case, curetting, resection or amputation.

Before ever resorting to amputation, I would first cut into the tumor. The gross appearance would, in the great majority of cases, be sufficient to establish the diagnosis beyond question. But, if there were still doubt, a frozen section could be made, or, in my opinion, a better procedure would be to remove sufficient material for a thorough examination, close the wound and defer the final operation until a careful histological examination, by a competent pathologist, can be made. Cases in which this latter procedure becomes necessary should be extremely few in number.

Cases in which Exploratory Operation is Indicated—(1) Cases of sarcoma of the upper end of the tibia, or lower end of the radius, in which it is most important to know whether we are dealing with a mixed-celled or highly malignant sarcoma, or a giant-celled or myeloid type of sarcoma, of a lower degree of malignancy. The type of tumor in this case would determine largely whether it was necessary to sacrifice the limb, or whether one could be content with a conservative operation to be followed by a course of toxin treatment.

(2) The exploratory operation is indicated in periosteal sarcoma of both the shaft and the extremities of the long bones, especially in the early stages. Here, I do not believe we run a great risk of causing dissemination, and my experience has been that the sinuses following the operation heal much more readily than in the more deeply seated or central sarcomas. In addition, the risk of hemorrhage is not nearly so great. The principal disadvantage is that the microscopical examination may be negative. In cases in which we are still in doubt, we must determine on other and clinical grounds whether to operate or wait. One of my cases of myositis ossificans, reported before the New York Surgical Society at its meeting on December 11, 1912,² shows that it is not always easy to do the right thing, with all possible data at our command and all known aids to early diagnosis. In certain cases we are bound sometimes to fail. In spite of the disastrous ending in this particular case, I feel the proper course was pursued, at least at the time of the first exploratory operation, and I further believe, we were justified in delaying amputation after such a strong negative report of the pathologist's upon the material removed at an extensive exploratory operation. How long one should wait, is another question and can never be answered in general terms. With clinical signs of increase in size plus the characteristic appearance of a periosteal sarcoma shown in a skiagram, I am now convinced that in some cases, at least, one is justified in

² ANNALS OF SURG., March, 1913



FIG 5—Osteomalacia All long bones involved (Courtesy of Dr Gibney and Dr Dwyer)



FIG 6—Γ C Microscopic examination (1) chondrosarcoma one report (2) myositis ossificans, another report

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sacrificing the limb, even in the face of a negative pathological report

With regard to the difficulties and uncertainties of exploratory incision, Elmsley cites the following cases illustrating the point (*Royal Soc of Medicine*, November, 1912, Discussion):

In the Museum at St Bartholomew's there are two specimens of very great interest and importance. Each was a femur containing a patch of necrosis, and a large mass of inflammatory new periosteal bone around. Each of them was amputated under the impression that it was sarcoma, after exploratory incision into the tumor. They occurred before the days of skiagraphy, nowadays, no doubt, a good skiagram would lead to the correct diagnosis being made. In these two cases the exploratory incision failed because it was not carried deep enough. He believed that the majority of mistakes and failures after exploratory incision were due to the surgeon not cutting deep enough, or else not cutting into the right part. One such case occurred to him.

Mr Makins (*loc cit*) does not agree with Sir Frederic Eve in the opinion that the dangers of cutting into a sarcoma have been overrated. He cites cases in his own experience which convinced him that such exploratory operations sometimes cause a rapid generalization of the disease. The present custom is, never to cut into a sarcoma of the long bones unless prepared to amputate within 24 hours.

The following personal case illustrates well the difficulties that sometimes confront the clinician, when he has received two diametrically opposite or strongly conflicting reports from different pathologists.

F. C., male, seventeen years of age, son of a prominent surgeon in western New York State, had noticed a tumor at about the centre of the biceps muscle of the right arm for a period of 2-3 weeks. The father of the boy, who removed the tumor, gave the following history.

(January 24, 1914) "The tumor was firmly imbedded and adherent to the muscle, extending nearly to its outer surface and running clear through the muscle and attached to the periosteum, but not firmly attached. There was no encapsulation, the muscle fibres being directly adherent to the growth itself."

The patient had suffered no pain. Family history was negative. A portion of the tumor was submitted to three different pathologists, one, a pathologist of wide experience, stated that it was a chondro-osteosarcoma. The second stated that it was not malignant, at least only in a small degree. The third report, made by a distinguished professor of pathology in one of the leading medical schools in the country, read as follows:

"Sections of the tissues from the biceps in the case of F. C. show a picture, which I interpret as myositis ossificans.

"The muscle tissue is the seat of extensive fibrosis and in the centre of this fibrous area there are numerous actively forming bony trabeculae. The type of bone formed is over cellular and there are mixtures with cartilage. Quite a few giant-cells are found in some areas, but nowhere is the picture that of straight-forward sarcoma.

"Nevertheless, I feel that some traumatic sarcomas start in this way;



FIG 6—F C Microscopic examination (1) chondrosarcoma one report (2) myositis ossificans, another report

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four weeks. An aspirating needle drew only blood. Relying upon my clinical diagnosis of a very highly malignant tumor, I immediately operated, removing the entire testicle through a Bassini incision, as for an inguinal hernia, I also removed the cord as high up as possible. The entire tumor was sent to the laboratory and was very carefully examined by two of the most competent pathologists, one a professor of pathology in a leading medical school,—and the report was that no evidence of malignancy existed. Three months later, the patient entered Bellevue Hospital with a very large retroperitoneal tumor. An exploratory operation was done and a portion of the tumor removed by Dr. B. F. Curtis, microscopical examination at this time proved it to be sarcoma. The man died a few weeks later, the entire course of the disease covering a period of only five months.

Another very striking case in my own experience is that of a boy of twelve, with a very rapidly growing tumor of the scapula. A portion was removed by another surgeon and pronounced by a competent pathologist, hyperplasia, with no evidence of malignancy. The large tumor diminished to nearly half its original size under the mixed toxin treatment. The patient was then sent to my service at the General Memorial Hospital. The clinical as well as X-ray diagnosis of sarcoma being absolutely certain, I was desirous to have it confirmed by the microscope and therefore removed another good-sized portion of the tumor and had it examined by another pathologist who made the same diagnosis as the former. Shortly afterward the tumor began to increase in size in spite of further treatment, glands developed above the clavicle, one of these, the size of a hickory nut, was removed for microscopical examination and again a negative report was received. "No evidence of malignancy found." The disease progressed very rapidly and killed the boy within a few months, and, finally, microscopical examination confirmed the original clinical diagnosis of sarcoma.

In the discussion of sarcoma (*Royal Soc of Med*, November, 1912) it was stated, that there was at present little evidence upon which to base the prognosis in cases of chondrosarcoma. The following cases may be of interest in this connection.

CASE I.—*Subperiosteal sarcoma of the tibia*. E. McG., male, sixteen years. Family history negative. Personal history. Was struck over the upper portion of the right tibia by a hockey stick. One month later he noticed a swelling at the site of the injury and some tenderness but little pain. In March, 1911, the swelling, which was regarded as an abscess, was opened by a physician. Nothing but blood was found. The enlargement slowly increased in size. On April 20, a second operation was performed, and a tumor, apparently of periosteal origin, was found, fusiform in shape, beginning three inches below the joint and extending downward 5 inches. Some grayish-white, non-vascular material was removed. The substance of the tumor was found smooth and hard, without erosion, the growth evidently originated in the shaft of the tibia. A microscopical examination was made by Dr. Collison, pathologist of the Post-Graduate

yet the sarcomas are sarcomatous from the start, and this is not sarcoma"

I was asked for an opinion as to the best course to pursue. In view of my unfortunate experience with the case of myositis ossificans of the lower end of the femur, quoted in full in the *ANNALS OF SURGERY*, March, 1913, p 307 (Miss A)³—in which a highly malignant sarcoma eventually developed, followed by early metastases and death—I believed it wise to act on the supposition of a possible sarcoma in this case and, therefore, put the patient upon prophylactic doses of the mixed toxins of erysipelas and bacillus prodigiosus last January. He is still in good health without any trace of a recurrence.

Anent the same question Mr. Edred M. Corner of London (*The British Journ. of Surgery*, April, 1914) states: "For a long time some clinicians have recognized the doubtful value of the microscopist's diagnosis of sarcoma, particularly in children. Dr. Nabarro and Mr. Higgins have now reported most fully an indubitable case in which a similar doubtfulness was shown to exist in the diagnosis of carcinoma by 'most high' morbid anatomists. Such a record tells us that cases of the cure of malignant disease cannot be accepted when based upon mere microscopical evidence. The final court of appeal is the clinical court. And if the opinions of that court differ from those of the pathologists, the 'casting' vote is with the clinicians. All these considerations thrust increased responsibility on the clinician, who must not rest content with the mere practice of his art, but must keep abreast with and advance the science of surgery."

If we go outside of the strict limits of the long bone tumors, we find even more striking proof, that we should not attach too great weight to a negative pathological report of a specimen removed by exploratory operation.

Elmsley, in referring to two cases, the specimens of which he found at St. Bartholomew's Museum (femurs), states his belief that the majority of mistakes and failures after exploratory incisions are due to the fact that not enough tissue is removed to show the characteristic structure of the growth. I agree with him that this is probably true in the majority of cases in which the pathological reports are in error.

I recall one case that has impressed itself very strongly upon my mind, namely, that of a rapidly growing tumor of the testicle, immediately following an injury, and which had attained the size of a closed fist in

³The early report of the pathologist (Dr. Jas. Ewing) in this case read: "Seven different portions of the material received are under examination. In none of them is there the slightest trace of any form of sarcoma. The tissue shows chronic osteitis and myositis, such as commonly arises after traumatism to the bone or periosteum. The changes in the muscle are not those typical of myositis ossificans, and yet new bone appears to be forming in close proximity to the atrophying muscle. I should prefer to give the diagnosis of chronic formative osteitis."

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unusual amount of cellular elements, and on one surface these are proliferating freely and producing a mass of tissue having the characteristics of a spindle-celled sarcoma. There is no normal tissue included with the growth, so that we are unable to say to what extent it infiltrates. We must, however, regard it as a chondrosarcoma, probably not highly malignant."

In view of the pathological report, it was decided to wait. The wound healed by first intention. The progress was favorable until December 24, one month later, when hemorrhage commenced and continued from the sinus left by the drainage tube. The patient became rapidly worse, the pain was very intense, requiring morphine. An unusual feature of the case was the temperature which remained high, reaching 104° some evenings. Curettings removed through the sinus were sent to the Clinical Research Laboratory, which made the following report:

"These fragments are composed of a chondrosarcomatous growth, which consists of small spindle-shaped cells and a few myeloid elements. The cartilaginous tissue is small in amount and is infiltrated with calcareous material. There can be no doubt of the malignancy of the formation."

Amputation of the thigh was done on January 5, 1912. The patient made a satisfactory recovery, the wound healed by primary intention, his general health rapidly improved and he was discharged from the Hospital on February 7. All went well until March 10, when he began to have violent headaches, vertigo and vomiting. The tumor rapidly grew worse and he died shortly afterward from secondary deposits in the brain. There was no local recurrence. The earlier duration of the disease was less than 5 months.

A brief report of the following personal cases, bearing upon the malignancy of the disease, may be of interest:

Chondrosarcoma M, male, tumor of ilium. Patient was referred to me in 1894 by Dr Geo Shrady, with a very large tumor of the ilium. Microscopical examination showed it to be a chondrosarcoma. The tumor entirely disappeared under the mixed toxin treatment. Seven months later the disease recurred, grew very rapidly and killed the patient within a year.

Inoperable osteochondroma of infraclavicular region R B, male, referred to me by Dr J F Erdmann of this city in August, 1911. Patient had injured a rib eight years ago, 4 years later began to notice that his left shoulder was raised. Two years after that he noticed a hard, painless swelling in the left pectoral region just below the clavicle. This gradually increased in size and in 1910 began to interfere with the movements of the arm. The X-ray diagnosis was, "in all probability osteochondroma." I first saw the patient in August, 1911, at which time physical examination showed a markedly protuberant tumor occupying the whole left pectoral and axillary region, extending up to the clavicle. The skin was normal in appearance, although the veins were slightly enlarged. The tumor itself had a very hard, cartilaginous "feel." It was irregular, nodular, though somewhat variable in consistence. The left clavicle seemed to have been disarticulated from the

Hospital, who pronounced it simple chondroma, non-malignant. Primary union occurred. A local recurrence was noticed six weeks later. An X-ray taken before the operation showed nothing characteristic. A third operation was performed on June 25, 1911. The tissue at this time was examined by Dr Jeffries, pathologist of the Polyclinic Hospital, and pronounced mixed-celled sarcoma, of mild malignancy. A small swollen gland beneath the sartorius muscle, the size of an English walnut, was removed. The tumor recurred almost at once and grew very rapidly.

Physical examination by myself, September 6, 1911, showed a very large tumor at the junction of the middle and lower third and extending to the upper end of the tibia which was three times the size of the other side, there was a fungating mass in the centre, bleeding easily. The disease ran a rapid course.

This case again proves that we cannot place too implicit reliance upon a negative pathological report, or a report of a benign lesion in tumors of the long bones. The first report of the pathologist read Chondroma, non-malignant, in spite of an almost immediate recurrence, with rapid growth, the report of the second pathologist stated Mixed-celled sarcoma of mild malignancy. Recurrence again quickly followed with metastases in the glands.

My experience in sarcoma of the long bones and, in fact, bones in general, has been that in certain cases, a tumor, pronounced pure chondroma by the pathologist, promptly recurs, and may exhibit a high degree of malignancy.

That chondrosarcoma may be of extreme malignancy, is shown by the case reported by Henry J. Clark, of the Doncaster Royal Infirmary, London (*Practitioner*, 1912, vol 46, p 869). The history in brief is as follows:

Youth, aged fifteen years, injured while playing foot-ball on October 3, 1911. He first consulted a physician on October 11, who took the trouble for a sprain. Seen by Mr Clark, November 1. Physical examination at this time showed a tender spot over the external semilunar cartilage, no swelling, joint freely movable. November 8, confined to bed, pains in all joints. Temperature 102° , thought to be acute rheumatic fever, there was no swelling. November 11, the pains had left the other joints but a stabbing pain remained in the right knee, which grew worse at night, temperature still higher in the evening. Bone abscess suspected. November 18, an X-ray was taken which showed a lesion in the upper end of the tibia.

Operation November 27, 1911, disclosed a cartilaginous tumor eroding its way into the head of the tibia, and apparently attached to the outer end of the epiphyseal cartilage. The tumor was excised and a small cavity, about $1\frac{1}{2}$ inches in size, was left in the head of the tibia.

The specimen was sent to the Clinical Research Association, London, for examination, and the following report was received:

"The bulk of the specimen is composed of cartilage, but it contains an

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unusual amount of cellular elements, and on one surface these are proliferating freely and producing a mass of tissue having the characteristics of a spindle-celled sarcoma. There is no normal tissue included with the growth, so that we are unable to say to what extent it infiltrates. We must, however, regard it as a chondrosarcoma, probably not highly malignant."

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sternum and raised $1\frac{1}{2}$ inches above its normal position. Just above the clavicle, apparently springing from it, there was a firmly fixed growth, not quite the size of a hen's egg. The axillary glands were not involved. The toxin treatment was begun with the result that under the treatment the tumor was reduced to four-fifths of its former size. At the end of two weeks an incision was made and broken-down tissue removed, free drainage was continued for two months. The patient's general health became greatly improved, so much so that he discontinued taking the toxins. Soon after the disease began to grow again and gradually attained to more than its original size. He was later treated by another surgeon with extremely large doses of radium. However, he died in the latter part of 1913. Dr Ewing's report in this case read: Pure chondroma.

Tumor of the femur, chondroma. Amputation below the trochanter (1909). Patient remained well for nearly five years, when she had a local recurrence in the gluteal region about the size of a child's head. This was removed by me in January, 1914. Microscopical examination, by Dr Jas Ewing, showed it to be a pure chondroma. Three X-ray treatments were given after operation and prophylactic treatments with the mixed toxins were given for two months. She is in good health at present.

Another interesting case associated with chondrosarcoma, I recently observed at St Vincent's Hospital on the service of Dr F S Dennis. The history is briefly as follows:

Male, thirty-seven years of age, tumor developed in the ilium shortly after a severe bruise from falling into a coal hole. In the course of a year it grew to a very large size, measuring 31 cm in both directions, and was entirely inoperable. A portion removed for microscopical examination was pronounced chondrosarcoma of spindle-celled type by the pathologist of the Bellevue Hospital. The mixed toxins were begun January 5, 1914, under my direction, chiefly local injections being made. Under less than a month's treatment the tumor became largely necrotic and fluctuating, I advised free incision and drainage under ether, which was done, the sloughing continued with very profuse discharge. One month later four applications of radium were given by Dr J B Bissell. The patient continued to improve, and was discharged from the hospital in April, in good condition, with only a small superficial sinus, an inch deep, remaining.

Subsequent Note—On June 5th, I made a physical examination of the patient and found no trace of the tumor, his health and weight had been restored to normal, and he had returned to work.

In many of the cases of periosteal sarcoma of the femur, I have found the presence of cartilage mixed with round- and spindle-cells, rather than pure chondroma. I believe, however, that the prognosis in such cases is not materially affected by the cartilage. They are all highly malignant.

Space will not permit a detailed report of these cases here. My paper on "Sarcoma of the Long Bones," published in 1907, contains a tabulated report of some of the cases, the subsequent histories of

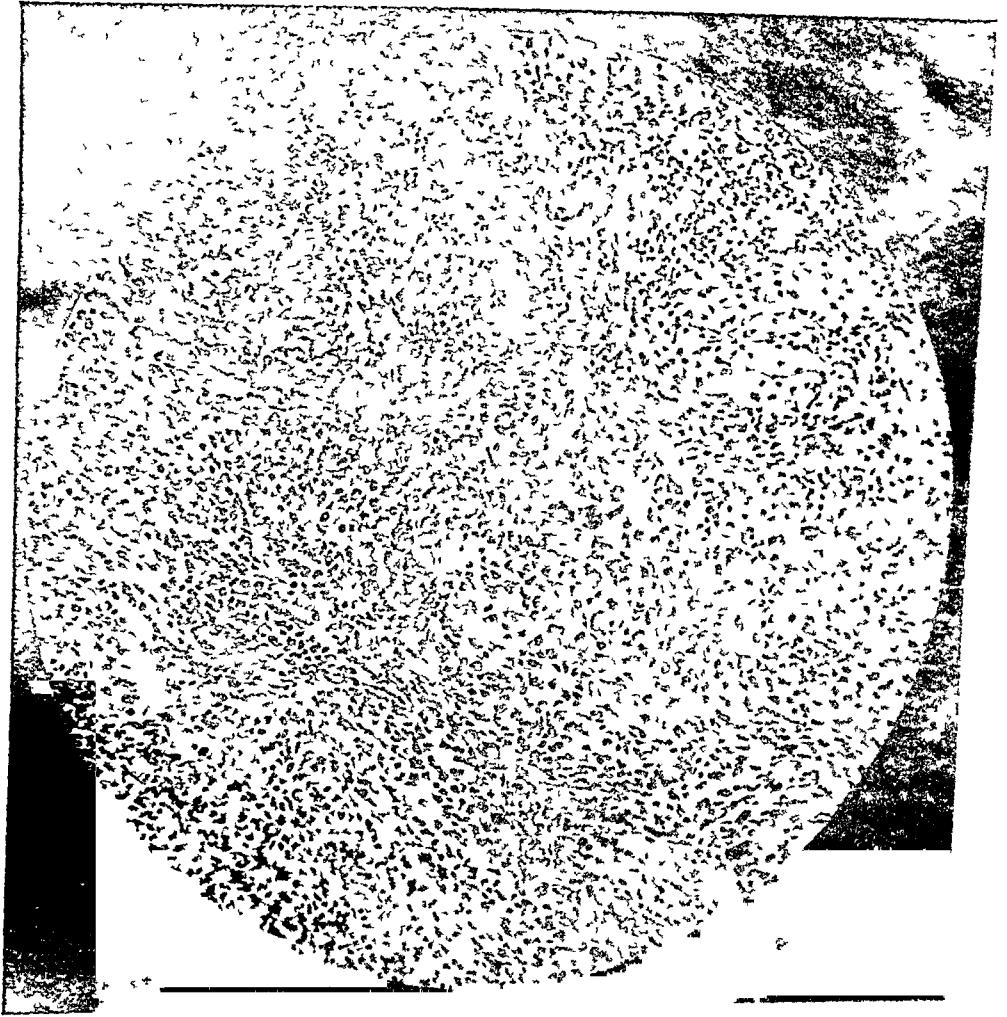


FIG 7 —F L Periosteal sarcoma of humerus, round- and spindle celled Patient with 6 or 7 years

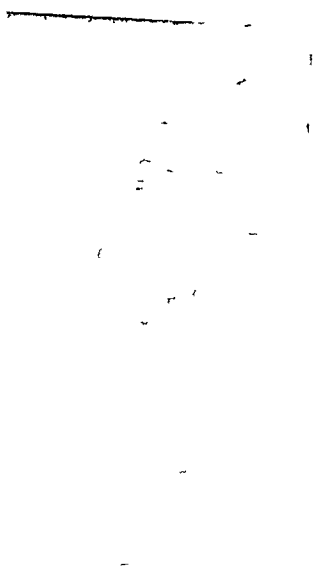


FIG 8—G M October 1912 Periosteal
sarcoma of femur Clinical and X ray diagnosis
Negative Wassermann

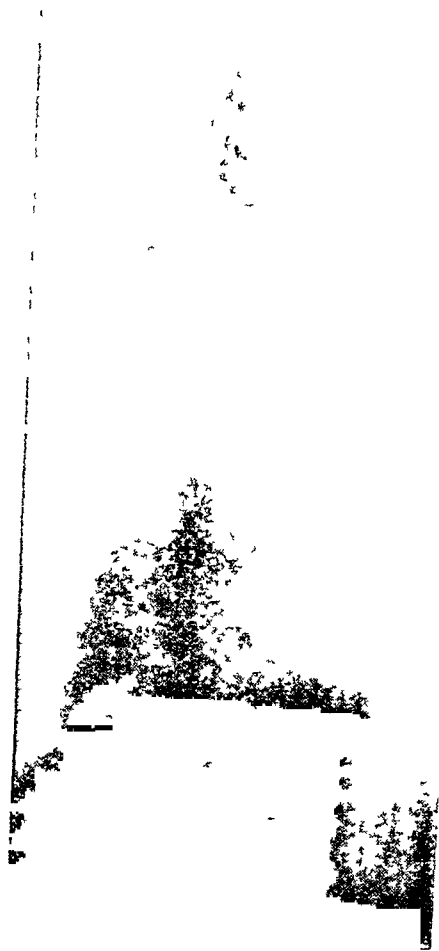


FIG 9—G M January 1914

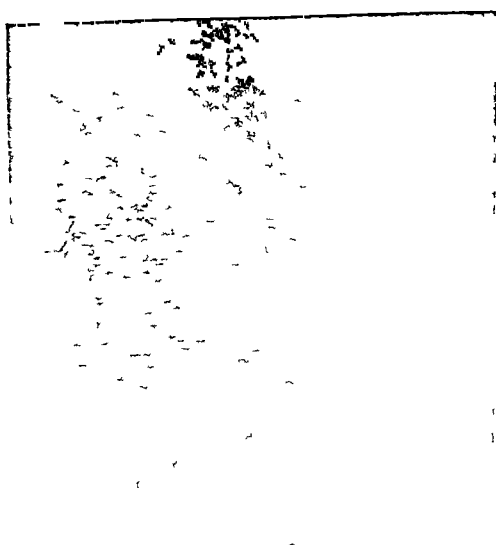


FIG 10 —G M January 1914

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which have been published in later papers I merely refer in detail to a few of the more important cases.

Sarcoma of the humerus F L, thirty-five years of age No history of cancer in the family, a man of splendid physique, six feet tall, weighing 180 pounds. Early in January, 1910, he fell and received a spiral fracture of the left humerus at about the junction of the middle and upper thirds. He was treated at the Hudson Street Hospital, and then returned to Baltimore, where he was treated by Dr. W. A. Fisher An X-ray taken at this time showed a spiral fracture without any trace whatever of a new growth Two to three weeks later he began to have severe pain at the site of the fracture Another X-ray photograph was taken, showing that in the meantime there had developed a well-marked tumor, apparently a sarcoma, involving both the central portion and the periosteum The growth increased rapidly in size, and was accompanied by very severe and constant pain

In June, 1910, an exploratory operation was performed by Dr J M T Finney, who found a large sarcomatous growth, involving both the central and periosteal portion of the humerus and extending from about the junction of the middle and upper thirds nearly to the head of the bone The bone was completely destroyed; a pathological fracture had occurred and there was a flail-joint. The central portion of the tumor was curetted, in Dr. Finney's opinion amputation offered no hope of a cure

The patient was referred to me by Dr. Finney for the toxin treatment, which was begun June 16, 1910, and continued in small doses, most of them being given systemically in the pectoral region and a few in the arm There was slow but steady decrease in the size of the tumor, and immediate cessation of the pain, which had been constant from the first appearance of the tumor The shell of bone about the tumor, which, as stated, had undergone spontaneous fracture, gradually became harder with the formation of new bone, and within a few weeks complete union had occurred The large cavity gradually filled up with granulation. Several curettements showed the material to be sarcoma of the same type as the original tumor, namely, spindle-celled The pathological examinations were made by Dr J C Bloodgood of Johns Hopkins and also by Dr James Ewing, Professor of Pathology at Cornell University Medical School Dr Bloodgood regarded it as of the very malignant type of sarcoma which he characterized as "bone aneurism"

Another X-ray examination in the latter part of 1910 showed that the new growth had apparently entirely disappeared and there was firm union of the arm The patient's general condition was excellent. In November, the granulations began to increase in size, and in spite of curetting, quickly recurred An X-ray taken in December showed a small shadow starting in the periosteum, in the axillary region, and I finally decided, early in January, to do a shoulder-joint amputation.

Six months later there was a very extensive recurrence in the pectoral muscle, the size of a closed fist The tumor was removed, but the operation was necessarily incomplete, and I had little hope of controlling the disease The toxins, however, were immediately resumed and the treatment persisted in for nearly six months longer Since that time he has had no recurrence, and

has remained in good health, working as a mechanical engineer ever since. A telegram received from him on April 8, 1914 (nearly four years later) stated that he was never in better health.

Another case of sarcoma of the humerus, successfully treated with the mixed toxins, with preservation of the limb as well as the life, is worthy of brief note.

A C, female, thirty-one years old, was operated upon by Dr J B Blake, of Boston, in 1899, for sarcoma of the upper end of the humerus involving the tip of the coracoid and part of the glenoid cavity of the scapula. It was impossible to make a thorough removal of the disease without a complete interscapulothoracic amputation. A very incomplete operation, consisting in practically nothing more than curetting, was performed, and the patient treated as an inoperable case and put upon the mixed toxins of erysipelas and bacillus prodigiosus which were administered under my direction. The toxins were given for 3-4 months immediately after the wound healed. The tumor entirely disappeared. Examination made by Dr Blake on December 11, 1903, four years later, showed the patient to have gained 10 pounds in weight, she was performing her regular work as housemaid. The motions of the shoulder (left) are anteroposterior, two-thirds normal, rotation, half normal, abduction to nearly 90°, beyond which point the elbow could not be raised.

Seven years later, in 1906, I personally showed the patient before the Surgical Section of the American Medical Association in Boston, and learned that she was in good health in 1913, 14 years after treatment.

June 12, 1914. In accordance with a letter just received from Dr Blake, the patient had a right cerebral hemorrhage about a year ago, which left her with an almost complete unilateral paralysis. He states that he saw her at the time, but could find no trace of sarcoma anywhere.

The microscopical examination in this case was round-celled osteosarcoma of the humerus. Inasmuch as there are practically no cases on record of sarcoma of the humerus cured by operation, even after as extensive a procedure as interscapulothoracic amputation,⁴ these two cases speak strongly in favor of the value of the toxins even in the most malignant types of sarcoma of the long bones.

Periosteal sarcoma of right femur. G M, female, twenty-seven years of age. In May, 1912, first noticed pain in leg, began to lose weight. A diagnosis of periosteal sarcoma was made on basis of clinical history and physical and X-ray examinations, and immediate amputation was advised, but refused. Patient was referred to me in September, 1912, and entered the General Memorial Hospital for the toxin treatment. Measurements over upper, middle and lower parts of tumor were as follows: Right, 16 inches, 18½ inches, 19½ inches, left, 15½ inches, 17½ inches, 18¼ inches. Wassermann reaction negative. I concurred in the diagnosis of periosteal sarcoma. At the end of a week, I made an exploratory incision removing a wedge-shaped portion of the tumor, which latter clinically had every appearance of a periosteal sarcoma originating in the shaft of the bone. The specimen was sent to Dr Ewing, who reported as follows:

⁴Mr Gask's statistical report of the results of operation in cases of sarcoma of the long bones observed at St Bartholomew's Hospital, London, from 1902-1911, shows not a single cure of sarcoma of the humerus.

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(September 28, 1912) "The tissue shows very little if any specific process and does not permit of a diagnosis. There is infiltration of the vessels with large round-cells, suggesting sarcoma, but which might very well be tuberculous. I ought not to express any opinion on the data received and I would not amputate without further information."

The toxins were begun, the initial dose being $\frac{1}{2}$ minim, which was carried up to 6 minims, injections being given 4-5 times a week. At the end of two weeks there was marked diminution in the circumference of the thigh. In view of the lack of certainty in Dr. Ewing's diagnosis, and the rapid improvement under the toxin treatment, I decided on November 1 to make another exploratory incision. Clinically the tumor had the appearance of a partially necrotic sarcoma. Dr. Ewing's report of this specimen reads:

"Five sections from five different parts of the tissue received fail to show any signs of sarcoma. There is suppurative inflammation in an area lined with granulation tissue. I find no signs of syphilis or tubercle. The condition suggests to me a pyogenic infection of the periosteum or osteomyelitis."

A number of X-ray photographs was taken by Drs. Cole and Holding, who believed the condition to be periosteal sarcoma. The tumor continued to decrease in size and at the end of six weeks the circumference of the thigh was nearly normal. The patient had gained ten pounds in weight. She returned home to have the toxins continued by her family physician. When I saw her again in January, 1913, the tumor had increased in size although her general health had remained good. Under larger and more frequent doses of the toxins, the tumor again began to decrease in size. The toxins were kept up until the latter part of 1913, 2-3 times a week in doses up to 12 minims, which were followed by moderate reactions. All injections were given systemically. X-ray photograph taken January 5, 1914, showed the density of the bone to have increased without any evidence of increase in size. As a sinus had persisted, I determined to enlarge it to see if a piece of bone had not been the cause of its failure to heal. Microscopical examination by Dr. James Ewing (of the tissue removed) reads:

(January 6, 1914) "The tissues in the case of Mrs. M. fail to show any definite evidence of a tumor. They represent dense fibrous tissue, the vessels of which are sheathed by numerous plasma cells. It is possible that these cells are a derivative of a perforating marrow tumor of the type of multiple myeloma, but the appearance is more suggestive of chronic inflammation. The wall of the sinus is lined by cellular and oedematous granulation tissue."

After this the sinus closed. The patient continued to gain in weight, and was shown by me before the International Surgical Congress in April, 1913, in perfect health, measurements of both thighs being the same.

The typical clinical picture at the beginning, the marked improvement under the toxins, followed by increased growth after the treatment was stopped, again followed by improvement on resumption of treatment, and final recovery of normal health, leave little ground for doubting the correctness of the clinical diagnosis of periosteal sarcoma, and the X-ray picture furnishes strong confirmatory evidence.

Were there no other cases of periosteal sarcoma on record in which a similar result had occurred, the diagnosis could not be accepted too implicitly.

without confirmation by microscopical examination. However, in case No 5 a much larger periosteal tumor of the femur with extensive metastases did completely disappear under the toxins, and the patient remained well for ten years. In this case the diagnosis was confirmed by microscopical examination made by Dr E. K. Dunham, Professor of Pathology at Bellevue University Medical School, and Dr B. H. Buxton.

At the discussion at the Royal Society in 1913, Sir Frederick Eve touched briefly upon the question of the use of the toxins in sarcoma of the long bones. He stated that he had not been convinced of their value as a prophylactic after amputation. His opinion was based upon a comparatively limited experience at the London Hospital at which institution the toxins had been tried in ten cases. Five of these were periosteal sarcoma, and it is worthy of note that the only case of the latter in which the patient survived the operation over two years was one in which the toxins had been thoroughly tried before amputation. At the time of the report, that patient was in good health and free from recurrence, 2 years and 7 months later.

That the toxins may materially alter the malignancy of the tumor, without destroying it altogether, is illustrated by one of my own cases, a very rapidly growing and extensive periosteal sarcoma involving the upper two-thirds of the femur, which I regarded entirely beyond hip-joint amputation. The toxins were given for a period of four months. At first there was some diminution in size, but later no further beneficial effect was noticeable. The patient returned home and later a hip-joint amputation was done at another hospital. This patient was alive and in good health when I last heard from him, 1½ years thereafter.

The most conclusive evidence of the value of the mixed toxins in periosteal sarcoma of the long bones, is furnished, I believe, by the case reported in full detail before the American Surgical Association a year ago (*Transactions of the American Surgical Association*, 1913, and *ANNALS OF SURGERY*, July, 1913). It is sufficient here to state that the patient, A. G., male, nineteen years of age, had a very large periosteal round-celled sarcoma involving two-thirds of the shaft of the femur, with very extensive metastases in the pectoral and ilio-lumbar regions. The case was regarded as hopeless. Prolonged X-ray treatment had been used upon the tumor in the femur (February, 1902). Also some X-rays were used in the pectoral region after the tumor had been partially excised, but no X-rays were used on the very large ilio-lumbar tumor involving the ilium. This disappeared under the toxin treatment alone and the boy remained perfectly well for ten years, when he developed a rapidly growing tumor at the site of the old X-ray dermatitis.

of the thigh, which tumor proved to be partly round-celled sarcoma and partly epithelioma originating in the soft parts, but not the bone, it proved highly malignant, causing death from metastasis shortly after the operation. In conclusion I may repeat what I have said in a previous paper

"In view of these results I think we are justified in giving-up of the traditional method of treating all cases of sarcoma of the long bones by immediate amputation. In most cases I believe it safe to wait for two or three weeks, the time required for a trial with the toxins, before sacrificing the limb. Sarcoma cases of extremely rapid growth will probably show little or no effect from the toxins, and one might naturally say valuable time had been lost by the preliminary use of the toxins. It is my opinion, however, that early operation in these cases would not have been of the slightest avail, as shown by the long, almost unbroken list of recurrences and deaths in cases treated by operation alone. On the other hand, in certain cases—probably a small number—the limb will be saved by the preliminary use of the toxins. In those in which early improvement is not marked, operation can then be performed with even greater chances of ultimate success than if the toxins had not been first used

"The greatest value of the toxins in sarcoma of the long bones will, I believe, be shown to lie in a judicious combination with conservative operative treatment. By such procedure a hip-joint amputation, which has been the almost uniform rule for sarcoma of the femur, will give place to an amputation below the trochanter, which will leave a stump of sufficient length to permit the wearing of an artificial limb, and this is no small gain. The toxins will be administered for a considerable period of time after amputation with the hope of destroying the cells which are left behind and which, with operative treatment alone, cause the local and metastatic recurrences. The same rules will apply to sarcoma of the humerus

"Coming to sarcoma of the tibia, fibula and radius and ulna, particularly of the myeloid type, in place of amputation as formerly advised and still advocated by the great majority of surgeons, we can safely substitute either curetting or partial resection, followed by a thorough course of the mixed toxins. While good results have been obtained from operation alone in a very limited number of cases in this group, I am convinced that the number of successes will be greatly increased by combining the toxin treatment with conservative operation, as I have suggested, and my series of cases strongly supports this opinion."

SUMMARY

The chief requirements for the early diagnosis of sarcoma of the long bones may be summarized as follows

- 1 A more careful study of all known clinical data
- 2 A larger clinical experience in the diagnosis of sarcoma of the long bones
- 3 Early and repeated X-ray examinations in all cases of suspected swellings of the long bones, especially those following trauma
- 4 Exploratory operation and microscopic examination of the tissue removed in selected cases, but *not* as a routine measure
- 5 Realization of the importance of not placing implicit reliance upon the negative report of the pathologist, especially when in conflict with clinical and X-ray evidence that is strongly positive

EXPERIENCES IN THE TREATMENT OF MALIGNANT TUMORS BY RADIUM *

BY RICHARD SPARMANN, M D.
OF VIENNA

My chief, Professor Freiherr von Eiselsberg, of Vienna, asked me to report his experience to date in the treatment of malignant tumors by radium in his service in the General Hospital of Vienna

Since July, 1913, we have handled 52 cases of inoperable malignant growths (carcinomas and sarcomas) I emphasize particularly the fact that all our cases were inoperable because from the very beginning we were convinced that we should not treat with radium any operable tumors Moreover, we have used radiation following an operation on tumors which were not radically removed In every case the clinical diagnosis of malignant tumor was confirmed by a histological examination

Before I go into any detail about these cases and the conclusions we came to, I would like to say a few words about our method of the application of radium We had 225 mg radium and 150 mg mesothorium at our disposal This quantity was divided into fifteen applicators These were applied partially externally and partially internally, in the latter case in the periphery of the tumor We often reduced the tumor as much as possible before the irradiation We also made use of cross fire The filters were made of silver, gold, platinum, magnalium, and brass, or of rubber in various thicknesses from $\frac{1}{2}$ to 2 mg

At first we gave big doses up to 11,000 mg hours at a time In the last five months, however, we used at the most 1200 to 2000 mg hours for one dose We made this change because we found that it had often such a great influence on the general condition of the patient, or that the radium destroyed the healthy tissues far beyond the limits of the tumor in too short a time In every case the patients were given arsenic in the form of Fowler's arsenic solution to improve their general condition

We divided our cases into two series, the first of which received preventive and the second curative treatment Of 6 treated in the first way, only 1 has remained free from recurrence Among all the cases treated

* Read before the American Surgical Society, April, 1914

curatively as well as preventively, only 11 have remained free from tumors up to this time. Of these 7 treated curatively were 5 cases of epithelioma cutis (basal zellencarc). One was a case of carcinoma linguæ, 1 a case of metastasis in the lymph-glands after sarcoma axillæ. Of the 4 treated preventively, 3 cases were carcinoma of the mucous membrane of the mouth, 1 sarcoma orbitæ. In 6 cases we noted improvement, 14 were aggravated and in 5 no effect could be seen during the period of treatment. Seventeen died. Of these 17 cases 11 died of tumor, mostly of cachexia, 1 from hemorrhage, 2 of meningitis, 1 of old age, 1 of diabetes, and 1 of mediastinitis.

Formerly, we had the hope that it might be possible to prevent, or at least retard, recurrence by preventive irradiation. Now, however, we have come to the conclusion that on the contrary the recurrence was sometimes hastened by post-operative irradiation, possibly due to a local hyperæmia caused by the radium.

From the above-mentioned results it is seen that radium is not a panacea for malignant tumors. Not only does it not always help, but it often even injures patients as well in regard to the local lesions as by its harmful effect upon the general condition, manifested by tachycardia with a pulse rate up to 120 and 140, dizziness, weakness, and vomiting. The latter has been observed especially after irradiation of the neck, probably due to irritation of the vagus. The local ill-effect is especially marked in that the healthy tissues are badly injured so that we cannot prevent their further destruction. There is furthermore a great danger of causing a hemorrhage or perforating a hollow organ, such as the intestines. We had 11 hemorrhages among our cases, 1 of them lethal. Another case died of mediastinitis.

There is no such thing as elective effect. The tumor cell is not more easily destroyed because of the specific action of the radium itself, but being a degenerated cell, it is more susceptible to the effect of any trauma. We have seen only a greater susceptibility of the epithelium in contrast to the fibrous tissue.

As far as histological changes are concerned, I can only make the statement that there is no specific change in the tissues to be seen by radium irradiation. All we see is only necrosis and subsequent scar-formation, such as could be formed spontaneously in any tumor tissue.

Radium has only a local effect, therefore it can never take the place of an operation by which we can reach as far as possible all parts of tumor dissemination as by the Wertheim operation of cancer of the uterus, or by the operation of cancer of the breast with removal of the

lymphatic glands We have noticed in certain cases that during the treatment metastatic foci have been formed in lymphatic glands

The indication for treatment by radium in the case of a growth which has attacked a vital organ must be the same as for an operation

The hopes, therefore, we placed in radium as a new and successful means in the treatment of malignant tumors have not been realized Moreover, the number of cases in which one might have recourse to radium therapeutics shrinks constantly as our experience progresses

OSTITIS FIBROSA CYSTICA *

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ACUTE intraosseous diseases of the long bones possessing a more or less clear etiology and definite clinical characteristics, present little or no difficulty in diagnosis, prognosis or treatment. With the quite multitudinous variety of affections of a chronic nature that may involve the same structures, the conditions and problems with which the surgeon has to deal are wholly changed. That quite different and definite pathological entities, some requiring little or none and others very extensive operative procedures, may be represented by essentially like clinical phenomena, is well known. This necessitates the most searching and scientific analysis of this group of cases, not simply from the academic standpoint but as an insurance of the ultimate welfare of the patient, for we must rely entirely upon exactness of diagnosis for a guide to the proper prognosis and treatment.

Upon a broad morphological basis we may subdivide the chronic intraosseous affections into

- 1 Those dependent upon infection
- 2 The purely metaplastic processes
- 3 The neoplastic, which are either benign or malignant

In the first group we encounter tuberculosis, lues and chronic osteomyelitis, primary or secondary, either diffuse involving large areas or circumscribed in the form of an abscess, the so-called *ostitis aluminosa*. The last group is represented chiefly by the sarcomata which vary greatly in their malignancy, and by the more rare and benign growths, enchondromata, myxomata and fibromata. In the second group or metaplastic type the one of chief importance is dependent upon that peculiar metamorphosis of a part or a whole of a single or many bones of the skeleton into fibrous tissue with a decided tendency to the formation of cysts.

Although previous to 1876 sporadic cases of bone cysts had been reported from autopsy findings, it was not until this date that Virchow definitely drew attention to their occurrence. Thirteen years later Hirschberg first observed and described *ostitis fibrosa*, but looked upon

* Read before the Philadelphia Academy of Surgery, April 6, 1914

it as a late stage of osteomalacia with the formation of cysts. Its identity as a separate disease was not established until 1891, when von Recklinghausen published his monograph. From this time until within the last few years little but academic interest was shown. In 1902 Koch collected 23 cases, while Heinecke, in 1903, published the report of the first case of bone cysts in which radiographic pictures were made. This was followed by the collection and study of 43 cases by Müller in 1906. Pfeiffer's paper appeared one year later and Bloodgood's in 1910 with analysis of 69 cases reported up to that date. Now that the radiograph has enabled the discovery of its rather frequent occurrence, we can no longer neglect its consideration in the study of many cases of obscure intraosseous lesions. It is with the hope of adding slightly to the slowly accumulating knowledge in regard to bone cysts that the report of our cases is made.

That a cyst of bone may result secondarily from any of a number of primary pathological changes is of course patent and is recognized by all writers on this subject. In reviewing the cases of bone cysts found in the literature, one sees that much confusion has arisen from this intermingling of secondary cystic changes or degeneration in other processes with those cases of true simple cysts. According to Silver, "the term 'bone cyst' should be used in a more specific sense to include those cases within the bone of a cavity filled with fluid as the most prominent symptom and in which no other definite disease can be discovered either from examination of the cystic contents or of the surrounding bone." Assuming that this restriction is reasonable and correct, we must exclude from the true bone cysts those dependent upon or secondary to

- 1 The liquefaction of subperiosteal hæmatomata which have become included by a surrounding shell of reactionary osteitis
- 2 Cysts occurring occasionally in callus
- 3 Those resulting from the breaking down of neoplastic growths, sarcoma, myeloma, fibroma, myxoma and enchondroma
- 4 Those appearing at times in Paget's disease and arthritis deformans
- 5 Cystic changes in osteomalacia
- 6 Echinococcus cysts
- 7 Dentigerous cysts
- 8 Cysts accompanying von Recklinghausen's disease or general osteitis fibrosa

No sharp distinction can of course be made between the latter and the cysts under discussion, except that of its limitation to one bone in

which the cyst formation is the prominent change while in general *ostitis fibrosa* they are of minor importance

The essential underlying process leading to the production of cysts is *ostitis fibrosa* of the type limited to a part or whole of a single bone. Although the nomenclature would place it among the inflammatory types of intraosseous affections, it cannot essentially be regarded as such, various opinions to the contrary, notably Bloodgood, who states, "I agree with all the more recent writers that the disease is an inflammatory one, in which the medullary tissue is replaced by a new formation of connective tissue with or without cyst formation and that the term *ostitis fibrosa* is not an inappropriate one, although it would appear that the term *chronic osteomyelitis fibrosa cystica* or *solida* would describe the condition more fully." Murphy is also of the opinion that it is an inflammatory process. While it may be a metaplastic process dependent upon a foregoing inflammation of a chronic attenuated character, in itself it has none of the ear marks which we associate with inflammatory changes. Its almost invariable situation at first in the centre of the bone, always at first a medullary occupant, its equal expansion in all directions with no sign of surrounding regeneration or thickening or active periosteal overgrowth, and the preservation of the latter in unbroken outline even when the periosteum is in direct contact with the cyst wall, all argue against our concept of osseous inflammation. On the other hand, the pathological picture of *ostitis fibrosa* is a strong witness for its metaplastic nature. The metamorphosis of the marrow into masses of fibrous tissue with subsequent degeneration of these fibrous masses into serous, mucoid or fatty material, portions showing cartilage or bony formation, all you will note of the same embryological type, corresponds perfectly with the changes in true metaplasia. This similarity has been well brought out by Freiberg.

The process usually shows a single cyst, of varying sizes, often egg shaped, with or without a lining membrane, the surrounding bone the seat of *ostitis fibrosa*. Cysts may, however, be multiple, unilocular or multilocular, the walls smooth or deeply ridged. Their contents have almost invariably been serous or blood-stained serous fluid. The cyst of the fifth metacarpal bone reported by McDill last October, when opened, discharged stringy mucopus. This cyst was not obviously one of those under discussion, occurring in a woman of sixty-five and apparently secondary to chronic osteo-arthritis. It should not be placed among the primary bone cysts.

The presence or absence of a lining membrane, except the greater

possibility of secondary neoplastic change, is apparently of little practical importance while it is possible that the lining is an asset acquired during the later life of the cyst. Engel's case of multiple cysts in which the smaller and presumably the younger cysts did not possess a lining while the larger ones were lined by a membrane of some thickness is suggestive, while even more convincing is the case reported by Silver where at a second operation for recurrence of a cyst of the upper end of the femur, in a boy of four years, a distinct lining membrane was found where at the previous operation twenty months before, the most careful examination failed to reveal any but a smooth, bony wall.

My first case which I am enabled to report through the kindness of Dr Frazier, is also illustrative of the lining membrane being an acquisition of the more mature cysts.

M T, male, aged twenty, Polish, was admitted to Dr Frazier's service at the University Hospital, October 1, 1913. A miner by occupation, two weeks previously he had been struck on the dorsum of the first metacarpal of the left hand by a piece of falling rock. This caused a slight wound $\frac{1}{2}$ cm in length which bled profusely and had continued to bleed at each dressing, being controlled with difficulty up to the time of admission. Fifteen years previously, or at the age of five, there had been noticed a swelling at this spot which increased gradually but without pain or interference of function. Between that time and the date of migration to this country, three years ago, two operations had been performed for this swelling. What was done or the nature of the process was unknown to the patient, who was very illiterate and from whom a detailed history could not be obtained. The wounds, however, always healed quickly and there was little or no change in the progress of the enlargement following these procedures. There had never been any pain and up to the last two weeks no tenderness or lameness. The patient had never been ill and absolutely denied venereal infection. Nothing was discoverable upon a general physical examination. There was no increase in leucocytes and the blood Wassermann was negative. Upon local examination, there was considerable swelling over the whole region of the metacarpal, which was enlarged, irregular in outline but smooth, except at the point of injury, where it was thought sharp edges of bone could be felt at the junction of the distal and middle thirds of the bone. The wound was slight, surrounded by quite an area of pigmentation and several enlarged veins. Only one scar was discoverable which was parallel with the long axis of the bone and $2\frac{1}{2}$ cm in length. The wound bled extremely freely and upon probing, bone was easily felt at the bottom. Temperature was 98.6° , pulse 72, respirations 20.

The clinical diagnosis was chronic osteomyelitis with possible incomplete fracture at the site of the injury. The radiograph, however, was somewhat disconcerting (Fig 1). It shows the whole bone tremendously enlarged, affecting all but the epiphysis. There is apparently no thickening of the periosteum which appears intact. The rarefaction or honeycombed appearance of the entire diseased area was remarkable, while no distinction between medulla and cortex

remained. This picture is more suggestive of a specific origin of the condition. Through the kindness of Dr Frazier, on October 15, under gas-ether anæsthesia, I exposed the bone by a longitudinal incision $2\frac{1}{2}$ cm in length with the wound at its centre and excising the old scar. Upon exposure, the periosteum was intact, but as soon as this was incised, the hemorrhage was profuse and continued to ooze from the bone. The exposed bone was extremely rarefied, fragile and consisted of many small liquified areas surrounded by the thin fragile shells. The contents of the cells was for the most part a thin gelatinous substance, but at places free blood and active bleeding was encountered. Bearing in mind the presence of enlarged veins over the site of the tumor, the radiographic picture and the gross appearance of the bone, I was inclined to think that the process was neoplastic rather than inflammatory. I therefore enlarged the incision and excised the bone *in toto* with its periosteum. The joint surfaces were uninvolved, but the surrounding tissues were like the bone the seat of greatly increased vascularity. Hemorrhage was controlled with difficulty and the wound closed without drainage, the hand dressed in extension. With the exception of some slight superficial infection, the wound healed without reaction.

The pathologic histology proved all previous diagnoses erroneous. The excised bone was 8 cm in length, the external surface rough and irregular, containing in some places normal periosteum, but for the most part this covering was thickened with fibrous tissue and contained many points of calcification. The articulating ends of the bone were normal in appearance, their surface smooth and regular. Section in the longitudinal axis revealed a surface presenting a honeycombed appearance, the structure being made up of a trabecular bone formation containing many minute cavities and a few larger ones about the size of peas. The contents of these cysts was putty colored, soft in consistency, and in some places yellowish in color, evidently containing fat.

Microscopic examination of this putty-like material revealed a few fat droplets and a homogeneous structureless substance. Section of decalcified bone showed a dense fibrous overgrowth associated with many bone trabeculae. The compact bone itself showed evidences of rarefaction and cyst formation, the Haversian canals being dilated beyond their normal calibre and in many free blood was seen. Some of the larger of the cysts are lined with a cellular formation which resembles recently formed granulation tissue, in that it consists of many leucocytes, embryonic connective tissue and new blood-vessels. The ground substance of the decalcified bone consisted in part of cartilage, of true bone and of areas in which the transition between cartilage and bone was apparently taking place. The gross and histological picture corresponds to the disease described as *ostitis fibrosa cystica*.

On the third day following operation, the temperature was normal and remained so thereafter. On November 5, or twenty-one days later, a section of rib 6 cm in length was transplanted by Dr Frazier to take the place of the excised bone. Fig 2 shows this graft in position one week later. Again the wound healed *per primam*. The patient was discharged from the hospital on December 1. He could move the forefinger at the metacarpophalangeal joint through an arc of 35° . Efforts have been made to get into touch with this patient to learn the later results, but so far I have been unsuccessful.

OSTITIS FIBROSA CYSTICA

Reported cases show that simple cysts may be located in nearly every bone of the body, even the skull, although I have not found any mentioned as occurring in the ribs or vertebræ, and but one case has been previously mentioned where the metacarpal bone was affected. Bloodgood, in a review of 65 cases of simple cysts, found none. Muller did not find any of this bone. Pfeiffer records one which is also mentioned in Silver's list. McDill's case, already mentioned, cannot be admitted because, from its contents, it was undoubtedly of infectious origin. In 50 cysts collected by Muller, 38 per cent were in the femur, 22 per cent in the tibia and 16 per cent in the humerus, the three bones most frequently affected. Bloodgood reverses this order and places the humerus first and tibia last. Of Pfeiffer's 49 cases, 19 were in the femur, 14 at the upper end, 12 of the tibia with 9 at the knee, and 10 of the humerus with 8 at the shoulder. Silver in a very thorough review of the literature up to 1911, collected 97 true bone cysts. Of these, 31 were in the femur, 25 in the humerus, and 15 in the tibia.

Since Silver's paper, six cases besides the three to be reported tonight, have been put on record. Canaguier reports one of the upper end of the humerus, Ashhurst one in the same position, Murphy reports two of the humerus, both at the shoulder, one at the upper end of the tibia, and one of the femur at the hip. The case of multiple cysts reported by Percy is not admitted because more than one bone was involved. So, also, McDill's case for the reasons already given. This brings the list of true bone cysts reported up to the present up to 103, of which 32 are of the femur, 29 of the humerus, and 16 of the tibia. To this number I wish to add the following case, which occurred on Dr Frazier's service at the University Hospital in September, 1911.

C S (Univ of Penn Hosp, No 10124), male, aged fourteen, was admitted to the hospital on account of pain and tenderness in the right thigh above the knee. Twenty-one months previously he had fallen while sliding on the ice, hurt his right thigh, and had some pain and limping, lasting but a few days. One month later he fell again, was picked up unable to walk and taken to a hospital, where he was treated for a fracture of the right femur about three inches below the trochanter. He was in the hospital for three weeks and was discharged with the limb in a cast. This was removed at the end of another two weeks. After a period of some disability and limping, he had no further pain or tenderness, although he noticed that the right leg was slightly shorter than the left. On the day of his admission, he was running when without any apparent cause the right leg suddenly gave way and he fell in a heap. He had considerable pain localized to the site of the old fracture which was marked by a lump on the outer side of the thigh. Family and personal history were absolutely good and there was no suspicion of lues. General physical examination showed a normal healthy boy of fourteen.

The right thigh at the juncture of the middle and upper thirds showed a well marked outward angulation with projection of a hard, rounded, irregular bony mass the size of a large orange. On slightest movement he complained of severe pain running through the tumor, but no crepitus or preternatural mobility could be elicited. There was a shortening of one inch between the tip of the great trochanter and the external malleolus on the affected side. There was distinct eversion of the right foot which the patient could not correct. The patient later stated that the tumor on the outside of his thigh had been present with gradually increasing size ever since his first accident.

The radiograph (Fig 3) shows the large cyst surrounded by normal appearing bone situated at the site of the former fracture and a second incomplete fracture breaking in to the cystic cavity. For seventeen days the limb was kept in extension with side splints which resulted in a reduction of the shortening to one-half inch. In the meantime, however, the radiograph had shown the presence of two other cysts of almost the same size and separated from the first by thin bony partitions. On October 7, under gas-ether anæsthesia, the patient was operated upon by Dr Muller. Through a longitudinal incision directly over the tumor, the bone and site of fracture were exposed, the cysts opened, curetted and allowed to fill with blood clot. The walls of the cavities were smooth and lined with a thin membrane resembling newly formed granulation tissue in that it was soft and easily bled. The wound was closed without drainage, while the Buck's extension and side splints were reapplied. The wound healed perfectly, convalescence was normal, and on November 18 the patient was discharged with good functional result and legs of equal length. Fig 4 is a reproduction of the radiogram taken one month after operation, and shows union at the point of fracture with beginning obliteration of the cysts as evidenced by the decreased translucency. Fig 5 is the radiogram taken two months after operation, showing still further reduction of the cysts.

It is, of course, questionable whether or not the *ostitis fibrosa* was present previous to or resulted from the trauma of the first accident. From the comparatively slight traumata to which the limb was subjected in all three injuries, it seems more probable that the process had already begun prior to the injury 21 months before.

The cysts almost invariably occur in the metaphysis, near the epiphyseal line, but practically never invading the epiphysis itself. Situated most frequently in the upper or lower one-third of the shafts of the long bones of the extremities, it is five times more frequent in the proximal than in the distal ends, while in the humerus and femur it is situated at the shoulder or hip seven times to once at the elbow or knee.

Ostitis fibrosa, the underlying or primary stage of cystic disease, is undoubtedly an affection of the developmental age of bone. Thus in childhood and adolescence by far the greater number of cases come to notice. In Pfeiffer's 49 cases, 70 per cent occurred prior to twenty years of age, and 85 per cent before thirty. This is comparable to



FIG. 1 —Ostitis fibrosa cystica of second metacarpal bone



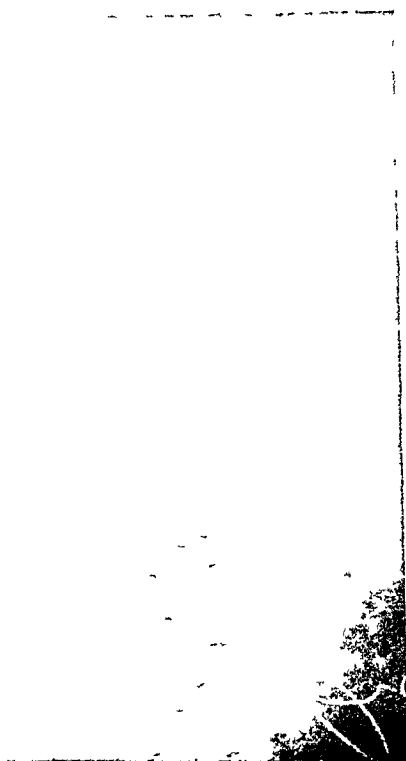


FIG 3 —Radiograph of Case II on admission Shows the largest of the cysts and line of spontaneous partial fracture



FIG 4 —Radiograph in second case male aged fourteen One month after operation Cavity filled with clot Shows union of fracture and beginning obliteration of cysts Shows other cysts

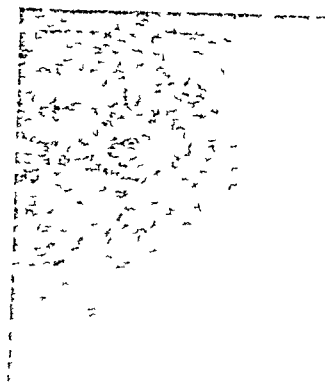


FIG 5 —Second case two months after operation Shows almost complete resolution and obliteration of cavities

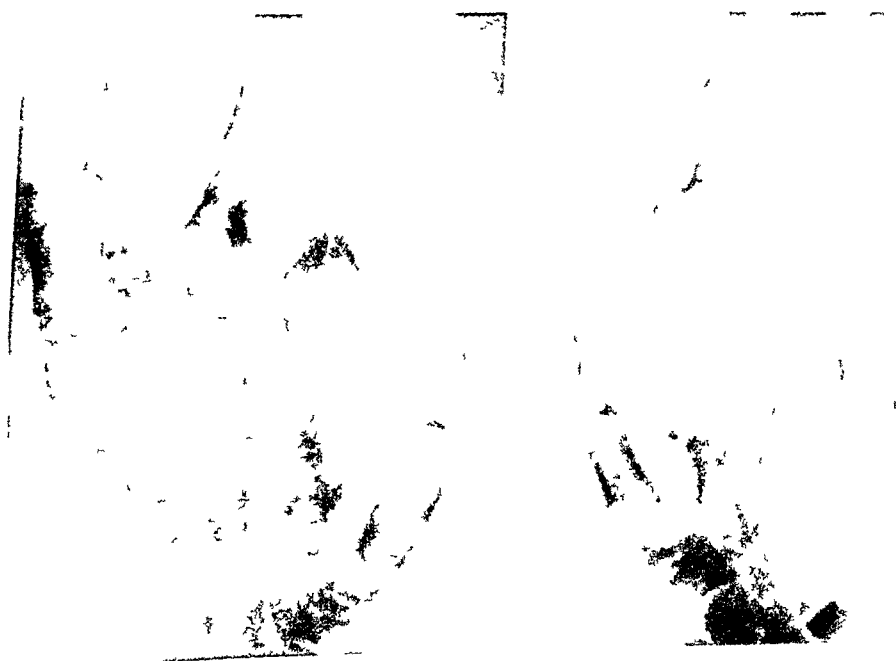


FIG 6 —Multiple enchondromata of both hands showing cyst formation in proximal phalanx of fifth finger right hand Female aged sixteen



FIG 7—Radiogram in case of ostitis deformans of femur Note great thickening and overgrowth of bone with rarefaction and eburnation occurring simultaneously Male



FIG 8—Radiograph in Case III Fracture at site of cyst in base of proximal phalanx of index finger



FIG 9 —Radiogram of Case III taken two years after fracture. Practically no change in the bone condition but perfect union of the fracture. Magnified thirty-eight.

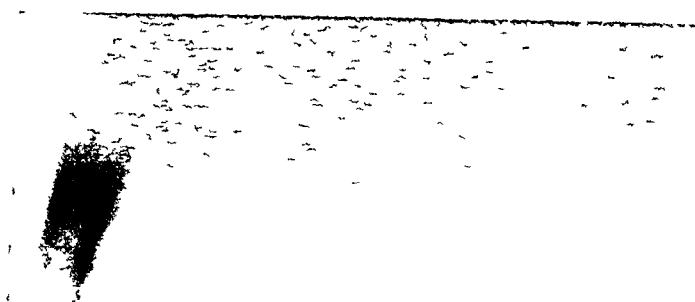


FIG 10 —Osteomalacia. Female, aged one year. Shows characteristic changes in the metaphyses and of the shaft.



FIG 7 —Radiogram in case of osteitis deformans of femur. Note great thickening and overgrowth of bone with rarefaction and eburnation, occurring simultaneously. Male.



FIG 8 —Radiograph in Case III. Fracture at site of cyst in base of proximal phalanx of index finger.



FIG 9 —Radiogram of Case III taken two years after fracture Practically no change in the cystic condition but perfect union of the fracture Male aged thirty-eight



FIG 10 —Osteomalacia Female, aged one year Shows cystic changes Note involvement of epiphyses and of left tibia



FIG. 7.—Radiogram in case of osteitis deformans of femur. Note great thickening and overgrowth of bone with rarefaction and eburnation, occurring simultaneously. Male.



FIG. 8.—Radiograph in Case III. Fracture at site of cyst in base of proximal phalanx of index finger.

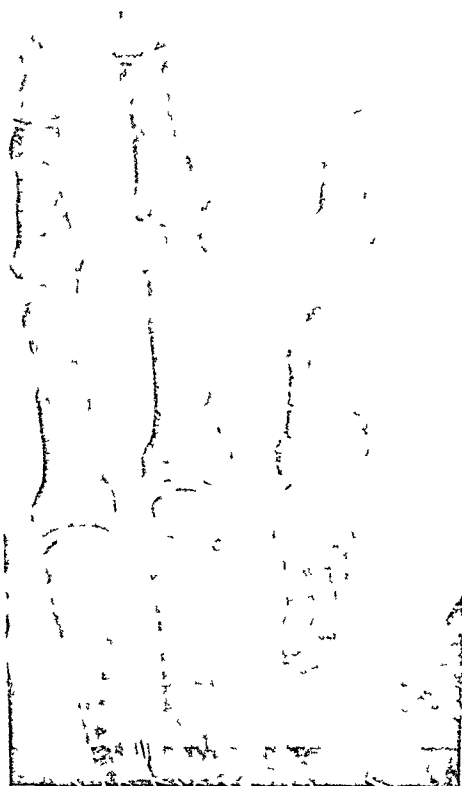


FIG 9 —Radiogram of Case III taken two years after fracture Practically no change in the cystic condition but perfect union of the fracture Male aged thirty-eight

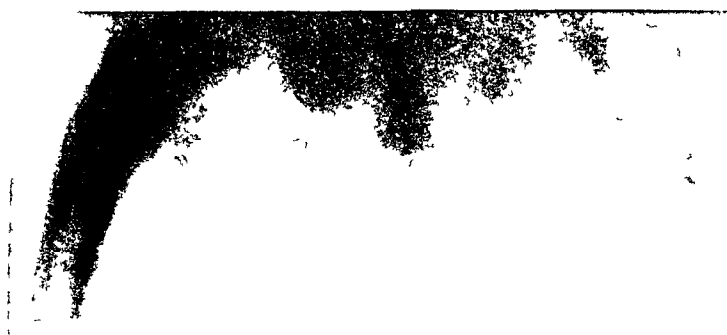


FIG 10 —Osteomalacia Female aged one year Shows cystic changes Note involvement of epiphyses and of left tibia

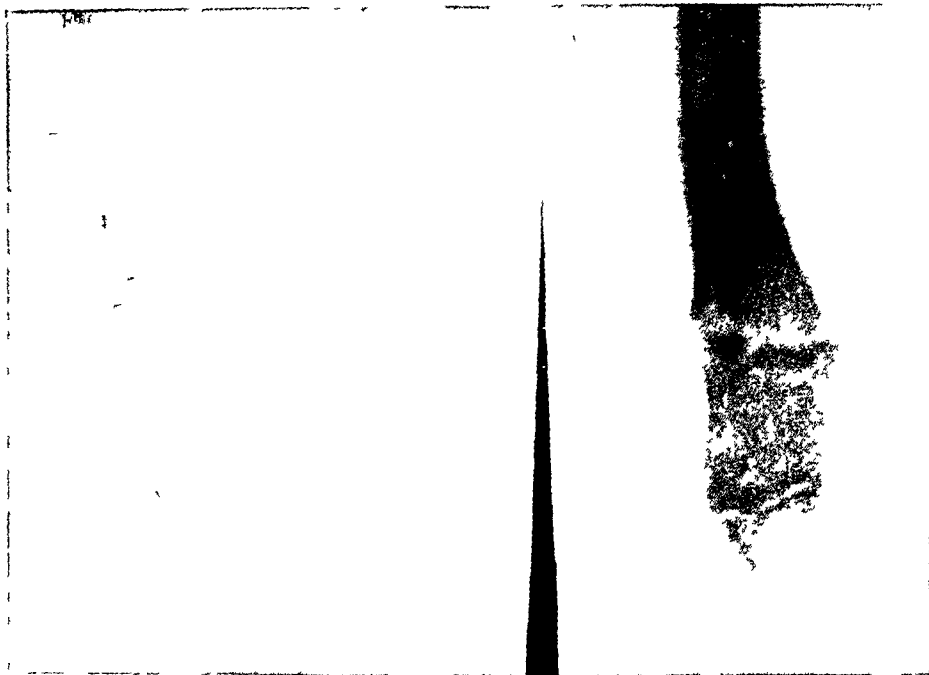


FIG. 11 —Osteomalacia. Discovered accidentally after radiograph for incomplete fracture caused by stumbling. Note compensatory hypertrophy of femur bracket formation. Female aged three.



FIG. 12 —Specific dactylitis. Involvement of epiphysis.



FIG 13 —Medullary sarcoma upper end of humerus with softening Destruction of bone, fracture and involvement of soft tissues



FIG 14 —Radiogram of sarcoma of tarsus with beginning cystic changes in the centre

Muller's series in which 67.5 per cent were before twenty and 82 per cent before thirty. In tabulating 97 cases, Silver found 67 per cent between two and one-half and twenty years, while 77.3 per cent were before thirty. Lack of detail in the reports of many cases probably places many of them at a much later age than they should be. The disease is so insidious, giving little or no disability and few symptoms, that it may be overlooked for many years. The youngest case reported was in a child of two and one-half—Silver had a case with onset at three years—while the average age of the 106 cases on record including the three reported here is twelve and one-half years. On sex is equally affected with the other.

The etiology of the benign bone cysts remains shrouded in obscurity. Various opposing theories without confirmatory evidence have been proposed. Thus Virchow believed them due to the softening of cartilaginous tumors. While cystic degeneration does undoubtedly occur in chondromata, they cannot be considered identical with the cysts we are now dealing with. As Bloodgood states, "Cartilage is never present in sufficient quantity to justify the conclusion that the cyst is due to the liquefaction of a primary or original area of cartilage." Fig 6 shows the radiogram of the hands of a patient, 18 years of age, suffering from chondromatous growths. They are identified chiefly from their multiplicity, their preference for the epiphysis and the peculiar mottled appearance so well illustrated in this specimen. Two of the growths, on the fifth finger of the right hand, have undergone cystic change.

Beneke likens these cysts to the apoplectic cysts of the brain, the hemorrhage, caused by an initial trauma, for some reason or other is neither absorbed nor does it become organized. Others, notably Lubarsch, and Ropke, believe that they result from infection. They have found organisms in the cyst contents. Von Recklinghausen in 1911 stated that most benign cysts were due to *ostitis fibrosa*, the solitary cysts to a localized form of this disease. As to the cause of *ostitis fibrosa*, von Recklinghausen believes that trauma or some mechanical factor is the important agent. Boit considers that it may result from various causes, infectious, metabolic, traumatic, toxic or perverted internal secretions. Rehn likens it to the snuffle disease of hogs, an overdevelopment of a normal process, while Bockenheimer believes *ostitis fibrosa* and Paget's disease one and the same, pathologically. Fig 7 shows the radiogram of a case of *ostitis deformans* in a male well within the age of the occurrence of *ostitis fibrosa*. One notes at once the difference between this process and the latter, the extreme rarefaction

without the clear picture of cyst formation, the areas of rarefaction going hand in hand with areas of bone proliferation and eburnation, great thickening of the periosteum on the inner side and obliteration of the marrow cavity with true bone formation

The balance of evidence is undoubtedly in favor of trauma as the initial factor in most cases. Thus in the 97 cases collected by Canaguier, the author states that trauma was known to precede the cystic formation in about two-thirds of the cases. Its occurrence during the developmental age when the bones are more susceptible to traumatic influences, and when repeated traumata are most frequent, their situation in the long bones which bear the brunt of blows and falls, and at positions in these bones receiving the balance of strain and where the cancellous tissue is most pronounced, all favor this explanation.

Benign cysts of bone like other chronic intramedullary diseases, have little symptomatology of their own, until they have progressed to the stage of causing interference in function, deformity, encroachment upon more sensitive structures, as the periosteum, causing pain, or so weakening the bone as to permit fracture from slight trauma. They may exist for years without giving any noticeable symptoms and be discovered accidentally by the radiograph. Most commonly the initial symptoms are local swelling or deformity. Pain is not a prominent symptom, when occurring is usually slight, often varies with atmospheric conditions, the so-called rheumatic type. When severe, some other condition should be suspected. Silver mentions pain as the initial symptom in 25 per cent of his cases.

Fracture is the chief feature if not the most common symptom of cyst, as it is frequently the reason for seeking surgical aid. Fracture usually occurs spontaneously or by slight trauma and may recur with good healing in the intervals several times. Thus in a case recorded by Murphy in a boy aged twelve, with a cyst in the upper extremity of the humerus, the initial symptoms were slight variable lameness and tenderness, followed during the course of a year and a half by four incomplete fractures from slight traumata. In the 49 cases collected by Pfeiffer, pathological fracture occurred in 20. The following case is illustrative of the often symptomless course of this disease prior to fracture. I am indebted to Dr G V Janvier, of Lansdowne, Pa, for opportunity of studying this case.

J H, aged thirty-eight, a janitor. In May, 1912, he was holding a horse by the halter. The horse suddenly jumped, causing a sudden tightening of the man's grip in the halter ring, when he felt the index finger of his right hand suddenly give away. Pain, tenderness and disability were so great that he

consulted his physician, Dr Janvier, who diagnosed fracture of the proximal phalanx and referred the patient to Dr Pancoast for radiography. The radiogram (Fig 8) shows an oblique splitting fracture of the phalanx running upward and forward through a cyst and entering the joint. This was the first evidence that a cyst existed. The patient had never to his knowledge injured this finger, had never had any pain, stiffness or tenderness in this hand and had always been in excellent general health. The fracture was reduced, kept on splints for three weeks, healed perfectly, and since then he has experienced no pain or tenderness. There is limitation of motion in flexion, this function is capable through an arc of only 45 degrees. This is probably due to involvement of the joint in the fracture. At present there is only slight enlargement of the bone. Fig 9 shows the condition as it exists at present, perfect union with very little change in the cyst itself. Fractures involving cysts almost invariably undergo perfect union. Egg-shell cracking when the cyst has become so large as to be covered only by the thinnest shell of bone is sometimes encountered.

As stated in the beginning of this paper, the diagnosis of the benign cysts from other more malignant growths requiring vastly different treatment, is of essential importance. The characteristics distinguishing these benign lesions are their latent and long continued growth, with few or no subjective symptoms, their age of onset, their position most often in the extremities of the humerus, femur or tibia, never invading the epiphysis or joint, the frequency of spontaneous fracture, and the characteristic radiographic picture. The latter usually shows "a uniform, often egg-shaped, expansion of the bone, which gives the impression of having started from the middle and expanded equally in all directions, the central portion is definitely translucent to its very circumference, but mottled in varying degrees depending on the varying thickness of the cortex, the presence of ridges, or multiplicity of cysts, the cortex is thinned and narrow, but well marked and regular, the epiphyseal line is not involved."

From most other diseases of a benign nature the radiographic picture will differentiate. Figs 10 and 11 show rarefaction and cystic change in osteomalacia, Fig 11 disclosing a pathological fracture and the first intimation that other disease existed. Fig 12 is of a specific dactylitis, showing overgrowth and thickening of the entire phalanx, distinctly different picture from that of ostitis fibrosa, which never shows bone proliferation and the enlargement takes place only from the expansion of a cyst if present.

The lesion of prime importance in the diagnosis is sarcoma and particularly the benign medullary sarcoma or myeloma. While the latter is still intramedullary, it may be impossible from the radiogram of differentiation from ostitis fibrosa cystica. Its more destructive rather than

expansive character, the early appearance of pain and interference of function, the more rapid growth, its irregular progression, indefinite outlines, its opacity, its early rupture through the periosteum and the involvement of surrounding parts, will usually aid in the diagnosis. Bloodgood states that no case of the more malignant forms of sarcoma of bone has come under notice after the process had been present more than two years—while in the benign bone cysts the symptoms bringing the patient to the surgeon are of much longer duration or unnoticed until the time of fracture. Figs 13 and 14 show the characteristic appearance of sarcoma in the radiogram, Fig 13 of the upper end of the humerus with destruction of bone, pathological fracture and invasion of the soft structures of the shoulder. Fig 14 shows the growth involving the tarsus with cystic degeneration in the centre. The differing appearance of enchondromata has already been mentioned. Ostitis aluminosa has its own characteristics, the irregularity and moth-eaten appearance of the walls, the surrounding condensing ostitis, the usual periostitis and the probable presence of sequestra.

Appearances of a like nature, plus the history and the Wassermann reaction, usually serve to distinguish a centrally placed gumma. It should be remembered, however, that at times even with all the facilities of modern diagnostic methods and long experience, a correct diagnosis is impossible prior to exploratory incision which should be done in all cases of doubtful nature, hence the necessity on the part of the operator of having the necessary pathological training in recognizing these conditions microscopically.

The treatment of benign cysts is either watchful waiting, or operative. The former is rarely justified unless the diagnosis is absolutely assured. If the expectant treatment is adopted, proper support to the bone, the correction of any deformity, and the use of methods for stimulating bone production should be employed. Cysts have healed or disappeared without operative interference, some without but most of them after pathological fracture with drainage of the cyst contents into the tissues and very probably the filling of the cavity with blood and serum from the line of injury.

The operative treatment has varied, all with good results, from simple puncture and injection to excision of a whole or part of the diseased bone. Von Mikulicz aspirated a cyst through a small opening in the shell and injected iodoform emulsion with good results. Until recently the more popular treatment seems to have been exposure of the bone, crushing in the wall of the cyst to promote regeneration, and

curettement of the cavity, the remaining excavation may be allowed to fill with clot, or is packed with bone chips, Moorhof's bone wax or bismuth paste. Since the more frequent use of autogenous bone grafts, resection or excision of the diseased area has been more frequently done. Thus Murphy has resected in three cases, twice the upper end of the humerus and once the upper end of the tibia, and replaced the excised portions with tibial grafts. In a cyst of the femur at the hip, after thorough curettement, he placed a tibial graft in the remaining excavation. Canaguier resected the upper end of the humerus and grafted the tibial crest. Both operators have had uniformly good results. Ordinarily, however, except in the small bones of the hands or feet and in the hands of most operators, resection is not justified if the diagnosis is certain.

Conclusions—1 Benign bone cysts are much more common than formerly supposed

2 Limited as true simple cysts, they are distinct entities, most probably dependent upon a localized *ostitis fibrosa*

3 The cyst is neither concomitant nor dependent upon other diseases

4 They adhere more to the metaplastic picture than to the inflammatory or neoplastic, although they may result secondarily from a chronic attenuated inflammatory process

5 Their etiology, unknown, seems in the large percentage of cases to be associated with trauma during the susceptible growing period of life

6 They have little or no symptomatology prior to the stage of bone weakening, permitting spontaneous fracture or fracture from slight trauma

7 Their chief importance lies in our ability to differentiate between them and other more serious lesions, mainly sarcoma, therefore recognition of their possibility, a careful history, local examination, with proper interpretation of the radiogram, are of the utmost importance

8 The healing of fractures occurring at the site of cysts is uniformly good and may result in cure of the cyst

9 Operative treatment, unless one can be quite sure from constant watching that the diagnosis is correct, is always justified

10 Although in selected cases and in the hands of experienced operators, resection with autogenous grafting has resulted favorably, curettement, crushing in of the walls and primary closure of the wound have been almost universally sufficient to procure a cure

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A REVIEW OF 100 CONSECUTIVE OPERATIONS FOR GOITRE WITH ESPECIAL REFERENCE TO THE TREATMENT OF HYPERTHYROIDISM*

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It is a rather significant fact that with the exception of Halsted, of Baltimore, no notable contributions on the surgery of the thyroid gland have been made by surgeons of the Atlantic seaboard towns. That this should have been so from the earliest days in the development of the surgery of the thyroid gland, I attribute to the geographical distribution of goitre, which is not so prevalent on the coast, but might be said almost to be endemic in regions following the great lakes from western New York and northern Pennsylvania into the territory of the great northwest. It is with some hesitation, therefore, that I venture to discuss the goitre question, and yet we are confronted sufficiently often with complicated problems to warrant a frank exchange of opinions.

Briefly, the review is based upon a group of 103 consecutive operations. I find there were 81 thyroidectomies, and 17 ligations of vessels, and 5 operations for thyroglossal cysts, more specifically there were 34 simple goitres, 29 adenomata, 1 sarcoma, 2 carcinomata and 32 hyperplastic (exophthalmic) goitres. There were 17 ligations, 8 of one and 9 of two vessels. Of the thyroidectomies, there were no fatalities, save one in the case of a large vascular sarcoma in a boy of 11 years. Of the ligations there were two fatalities in patients who, according to our more enlightened conception of the limitations of surgical therapy, would be now regarded as inoperable, at least in the acute phase at which the operation was performed.

Pathogenesis—As to the pathogenesis of goitre of the endemic variety, there has been a popular belief for many years that in some way drinking water played an important part. This belief, based at first upon purely hypothetical grounds, is receiving more and more substantial support from thorough scientific investigations, the most recent and the most convincing of which is that of Allison, who maintains that the disturbance of thyroid function is derived from a chronic intestinal toxæmia.

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LYNDON HOLT LANDON

REFERENCES

- Virchow Monatshefte d kgl Akad d Wissenschaften, 1876, 369
 Von Recklinghausen Festschr Rudolph Virchow, 1891
 Koch Archiv f klin Chir, 1902, lxxviii, 977
 Muller Univ of Penna Med Bul, September, 1906, p 173
 Pfeiffer Beitr Z klin Chir, 1907, 473
 Bloodgood ANNALS OF SURGERY, vol lii, No 2, 145
 Silver Amer Jour Ortho Surg, vol ix, 1911-1912, 563
 Freiberg Lancet, Clinic, 1913, vol cix, 504
 McDill ANNALS OF SURGERY, vol lvi, No 4, 533
 Engel Inaug Dissertation, Geissen, 1864
 Canaguier Arch prov de Chir, October, 1912
 Ashhurst Trans Epis Hosp, 1913
 Murphy Clinics of J B Murphy, vol i, No 5, vol ii, No 5
 Percy Surg, Gyne and Obste, vol xvii, No 5, 536
 Beneke Quoted by Percy
 Lubarsch and Ropke Quoted by Percy
 Boit Archiv f klin Chir, xcvi, 515
 Rehn Beitr z path Anat u z Path, 1908, xlv, p 274.
 Bockenheimer Arch f klin Chir, 1906, lxxx, 236
 V Mikulicz Zentralbl f Chir, 1904, xxx, 1323
 Jones and Morgan Arch of the Rontgen Ray, 1906-1907, No 11, 316-342
 Elmslie Brit Med Jour, November 16, 1912, p 1367
 Stumpf Deutsche Zeitschrift f Chir, 1912, pp 114-117
 For a complete list of references and reported cases, refer to the articles of Bloodgood, Muller, Strumpf, and Silver,

exophthalmos is almost sure to develop, (4) that no matter how intense the intoxication from an adenomatous or colloid group not associated with hyperplasia, exophthalmos will not develop

Classification—For a proper understanding of the goitre question, especially with relation to the indications for operation, one must be familiar with various pathologic processes and with their clinical expressions. No more beautiful and convincing example of the advantages of the closest cooperation between the clinical and pathological departments can be found than in the extraordinary accuracy with which the diagnosis and prognosis of clinical manifestations of thyroid lesions can be substantiated and foretold by the pathologist's report. The pathologist's study of the thyroid gland has proven beyond a peradventure of doubt that exophthalmic goitre is represented by certain definite essential lesions in the thyroid gland. A few years ago there was, however, some confusion as to what constituted true Graves's disease or exophthalmic goitre, and Kocher maintained, and with some justification, that American writers were not discriminating enough in their classification, in that they include all types of hyperthyroidism with their cases of the true exophthalmic type. This criticism has borne fruit in the elaborate combined pathological and clinical studies of Wilson and Plummer, who, as a result of the studies of the material from St. Mary's Hospital, have elaborated a classification which bears the closest scrutiny and satisfactorily provides for the group of doubtful cases that were neither simple nor exophthalmic goitres. This classification divides all goitres, excluding those of a purely inflammatory or malignant nature, into 4 groups.

Group I. Non-hyperplastic atoxic—the ordinary colloid goitre or adenoma

Group II. The non-hyperplastic toxic, representing 57.2 per cent of the total number. There are two significant facts associated with this group. First, that 23.3 per cent of the non-hyperplastic group presented some toxic symptoms, and, second, that there was an extraordinary difference between the average age at which these non-hyperplastic-toxic goitres appeared and the hyperplastic-toxic goitres of the exophthalmic type. In the former the average age was 22 years, in the latter 32 years. A still further distinction between these two groups is the significant fact that in the non-hyperplastic-toxic group (the simple goitre and the adenoma with toxic symptoms) the evidence of intoxication did not show itself until an average age of 36.5 years, that is, 14 years after the onset of the goitre, whereas in the true

The etiology of Graves's disease—true exophthalmic goitre—has provoked much discussion, and the most fascinating theory comes from Crile, who believes it to be a disease of the motor mechanism, which may be induced by overstimulation of the nervous system, in time causing an overproduction of thyroid secretion. To quote Crile's own words: "Graves's disease is not a disease of a single organ or the result of some fleeting cause, but is a disease of the motor mechanism of man, the same mechanism that causes physical action and that expresses the emotions, its origin is in phylogeny, and its excitation is through some stimulatory emotion, intensely or repeatedly given, or some lowering of the threshold of the nerve receptions, thus establishing a pathologic interaction between the brain and the thyroid."

There is little or no speculation on the part of those writing from the Mayo Clinic as to the factors which lead up to the definite pathologic changes which uniformly occur in exophthalmic goitre. It is regarded as a form of thyrotoxicosis in which the toxin, whatever may be its nature, acts directly on the more vital organs, more notably the central nervous and vascular systems, and that the clinical picture is made more complex by the interaction of those organs, whose functions have been directly disturbed by the toxin (Plummer). The most persistent and consistent opponent of thyroid hypothesis is Marine, whose work, because of its thoroughness and exhaustiveness, is always worthy of mention. Marine (*Journal of the A M A*, lx, p 325) believes that the thyroid hyperplasia of exophthalmic goitre behaves toward iodine as does any other thyroid hyperplasia of any animal thus far investigated. He even goes so far as to say that no specific or constant changes in the thyroid of exophthalmic goitre have as yet been demonstrated, that the iodine so far as it is at present known is identical with those iodine relations given to other clinical associations, and that the thyroid of exophthalmic goitre has no different pharmacological action on animals or therapeutic on myxoedema or toxic action on patients with exophthalmic goitre than thyroid preparations of other clinical associations with like iodine contents. These statements provoked a sharp criticism from C H Mayo, who insisted that Marine's observations lead him to conclusions not supported by surgeons of the present day. In further controversion of Marine's theory, Plummer stated (1) that hyperplasia of the thyroid never existed without a production of thyroid secretion in excess of the demands of the individual, (2) that exophthalmic goitre is a clinical entity associated with a definite pathological process in the thyroid, (3) that if hyperplasia of the thyroid is of a sufficient degree or extends over a long enough period,

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life history of simple goitres there are certain structural changes which take place spontaneously, perhaps physiologically, as in pregnancy and menstruation, that is, without artificial measures, during which periods the gland may increase in size temporarily only later to diminish to one of inconspicuous dimensions. We should warn the practitioner against the effect of the administration of iodine or thyroid extract, either of which may induce toxic symptoms in a hitherto benign condition, a condition which Kocher styles as "iodine Basedow," an artificial Graves's disease evoked by the administration of iodine in nervous patients affected with goitre. If the treatment is persisted in the patient may die under the same circumstances as in spontaneous Graves's disease.

TABLE II
SHOWING SYMPTOMS IN TOXIC CASES

Pathological diagnosis	Cerebral symptoms	Vasomotor disturbances	Mental irritability	Tachycardia	Tremor	Exophthalmos	Cardiac insufficiency	Loss in weight and strength	Diarrhoea	Edema	Headache	Jaundice	Vomiting
Non-hyperplastic-toxic (simple)	1	2	10	10	9	3	10	3	1	1	2		
Non-hyperplastic-toxic (adenoma)		8	17	17	4		17	6	2	2	1	1	
Hyperplastic-toxic		4	15	15	6	14	10	5	6	2	2	2	2
Toxic cases in which ligation was performed	1	6	1	17	10	16	12	7	9	3	1		6
Total	2	20	59	59	29	33	49	21	18	8	6	3	8

When consulted by the patient with simple goitre, colloid or adenoma, as to the propriety of operation, I present the situation somewhat as follows: that the operation is peculiarly free from danger, that the patient must decide for herself whether the swelling is enough of a personal annoyance to warrant its removal, that there is a tendency in a considerable number of cases for simple goitres to undergo certain changes which will affect the heart and nervous system, and eventually lead to permanent damage of the heart, kidneys, and liver, that in exceptional instances in later life goitres become cancerous. This, to my mind, is a fair presentation of facts based not only on my own experience, but on the statistics of large groups of cases. As to the risk of operation, there were no fatalities in my own series of partial thyroidectomies, in larger series we find the mortality in 561 cases, in the Clinic of the St. Mary's Hospital in 1913, to be 0.18 per cent. Of the

exophthalmic type, the hyperplastic-toxic, the toxic symptoms appeared on an average within a year

Group III The hyperplastic-toxic represented 42.8 per cent of the total number of specimens, and of these 99.2 per cent had toxic symptoms To this group belong all the cases of true exophthalmic goitre

Group IV The hyperplastic-atoxic, comprising but 1 per cent of the total hyperplastic specimens, may represent a slight margin of error

This classification, which conforms with extraordinary mathematical accuracy to the clinical syndromes of goitre, should, I believe, be adopted and serve as a working basis in the elaboration of our plan of treatment In an analysis of my own records, I find that 35.7 per cent belonged to the non-hyperplastic-atoxic group, 31.6 per cent to the non-hyperplastic-toxic group and 32.6 per cent to the hyperplastic-toxic group (see Table I)

TABLE I

Pathological diagnosis	Non-hyperplastic non-toxic	Non-hyperplastic-toxic	Hyperplastic-toxic	Total
Simple	20	14		34
Adenoma	12	17		29
Carcinoma	2			2
Sarcoma	1			1
Exophthalmic			15	15
Ligation cases			17	17
Total	35	31	32	98

Symptomatology—The clinical picture of thyrotoxicosis has been so frequently described as to permit of no amplification The relative frequency of the various symptoms is expressed in tabular form and calls for no especial comment Mention might be made of an unusual phenomenon in one of the series—a periodic swelling of the upper lip synchronous with exacerbations of the disease and the development of a Bell's palsy Whether the former was the outcome of some vasomotor disturbance of sympathetic origin is an interesting question The Bell's palsy may have been incidental or perhaps toxic

Surgical Aspects—With these introductory remarks, I come to the consideration of the surgical aspects of goitre and will discuss the surgeon's responsibility with reference to these various groups, and first of all with reference to the non-hyperplastic, non-toxic type By way of preface, I think one can truthfully say that goitre may be treated by both non-surgical and surgical measures We must remember too that in the

origin, for while the higher percentage of more serious cases will be found in the hyperplastic group, cases equally as serious but in smaller numbers will be found in the non-hyperplastic. We must assume at the outset that in most cases the toxic goitres run an essentially chronic course, to be sure with considerable variations and more or less frequent explosions, and that it has its fatal tendencies. That the mortality is high in unoperated cases is usually not appreciated by the general practitioner. In one family under my observation the elder daughter (File No 521) developed exophthalmic goitre and the physician and consultant strongly opposed operation. She died four years later at the age of 30—death was sudden and the doctor pronounced the cause of death as “apoplexy.” Two years after that her younger sister, who had symptoms of hyperthyroidism (File No 6650), was referred to me by the same physician for operation. The lesson had been learned, though at the cost of a human life.

For the sake of convenience we may distinguish between cases of a moderate severity and those of a more serious nature. Our advice to the cases of moderate severity depends upon their financial and social status. If conditions are such as to make it impossible to undergo an adequate course of treatment with the necessary physical and mental rest and perhaps change of environment, and if it will be necessary for the patient to return immediately after her treatment to conditions of employment which would predispose to relapses, we strongly urge immediate operation. In a number of mild cases, prolonged courses of treatment under competent physicians had been ineffectual and operation had to be resorted to. There have been no deaths in this series, and the results have been almost uniformly satisfactory.

As to the cases of more grave character, our plan has been not to give an opinion until the patient has been under observation for a week with absolute rest. Many of these cases come from a distance, are fatigued by travel, and are in a state of nervous excitement at the time of the first examination. They are put to bed and the condition of the cardiovascular system carefully studied. Usually within a week the condition will improve sufficiently to justify operation, or at least to determine with greater intelligence the mode of treatment to be adopted.

What should be considered contra-indications to operation? Kocher (*Brit. Med. Jour.*, October 1, 1910) regards chronic nephritis, enlarged thymus, and glycosuria as contra-indications, and in his writings lays great emphasis upon lymphocytosis and a decrease in the polynuclear cells as an index of the gravity of the case. In the blood analysis of my cases, I have not been able to confirm this statement. The follow-

chances of a thyrotoxicosis developing in simple goitres, the statistics from my clinic give a percentage of 41.1, while from the Mayo Clinic the percentage was 23. To put it in another way, one in four or one in three patients with simple goitre will develop a symptom-complex which in many respects, both as to the clinical picture and as to the gravity of the disease, is so closely analogous to true exophthalmic goitre as to be almost indistinguishable. With the exception of three or four of the true exophthalmic type, one of the most gravely sick in my entire series belonged to this group.

The patient (file No 14421), referred to me by Dr A R Johnson, of New Bloomfield, Pa., was forty-six years of age, 14 years ago the goitre first appeared, but there were no associated symptoms until 9 years later, when she developed shortness of breath, tachycardia, palpitation, diarrhoea, loss of weight and strength, and nervousness. The patient was emaciated, extremely nervous, her heart was dilated, the pulse was most irregular, and tachycardia extreme. She was given a short course of preparatory treatment, the left lobe was removed, and the superior thyroid artery ligated on the opposite side. Apart from an attack of acute dilatation of the stomach her convalescence was uninterrupted. The histological study showed no evidences of hyperplasia, the pathological diagnosis being colloid goitre with evidence of hemorrhage into the interstitial tissue and between the glandular acini.

Finally, as to the incidence of malignant degeneration of simple goitres, this is an important phase of the subject because, when malignancy can be recognized by the physical signs, the tumor has attained the inoperable stage in most cases. In my records there were five cases of malignant disease, three of these were recognized clearly as such before the operation, and the remaining two were recognized in their incipency only by the microscope. One of these (File No 25777) was found in an adenoma removed from a patient thirty-six years of age, who had had a goitre since she was eighteen, and began to develop symptoms of hyperthyroidism 14 years later, for the relief of which the operation was performed. The second case (File No 14422), referred to me by Dr William Glosser, of Williamsport, Pa., developed a goitre at the age of twenty-one, after the birth of her child, and from that time to the present she has had some disturbance of her circulatory and nervous system. The right lobe was removed and the pathologist reported adenoma with beginning malignant degeneration. The incidence of carcinomata is, therefore, a matter which must not be overlooked in the argument for or against operation.

In discussing the selection of cases of the toxic group for operation, I will include both those of hyperplastic and those of non-hyperplastic

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Drainage is the rule. In the toxic variety, the patients are admitted to the hospital with the understanding that if an operation seems advisable full consent is given to perform it at such time as the surgeon thinks best. Thereafter the subject of operation is never discussed in the presence of the patient or nurses, the patient is put to bed immediately, given seven minims of tincture of belladonna t.i.d., and an ice-bag applied to the neck or precordium and the formula for stealing the gland according to Crile's technic adhered to closely. This includes a rectal irrigation at 7.30 A.M. daily, a hypodermic of sterile water at 8 A.M., an "inhalation treatment" at 9 A.M. by the anæsthetist, and breakfast at 9.30. On the morning of the operation, an enema is given at 7.30 A.M., scopolamine gr. 1/200 at 8, morphia sulphate gr. 1/6 at 8.45, and at 9 the anæsthetist begins with the inhalation treatment and substitutes nitrous oxide, under the influence of which the patient is brought to the operating room.

I am thoroughly convinced of the advantages of anoci-association, although my practice of it is limited to the avoidance of harmful psychic stimuli before the operation. The infiltration of the wound with cocaine, quinine, and urea has seemed to complicate wound repair, and I believe can be dispensed with as relatively unimportant. At least since I have abandoned it the immediate results have been equally good, and the cosmetic effect better. While the elimination of harmful psychic excitation should be taken into consideration, is it not true that after the patient's confidence is thoroughly won, the mere thought of operation begins to lose its terror and thus the surgeon's personality counts as a factor in the working out of anoci-association? In one case I tested out the patient before the operation (File No. 24984). The superior thyroids and one inferior thyroid had been ligated at two sittings at intervals of several months. On her third admission the patient was sent for in the course of the morning clinic, I discussed the treatment in her presence before a group of students, told them what had been done for her, how much she had been improved, that further treatment would be required. The patient, during the months of her struggle for health, had come to place implicit confidence in me. I watched her carefully during this discussion and observed that she was comparatively calm and that her pulse was not accelerated by the ordeal. When asked whether she would like us to go on with the next stage of treatment, she expressed her readiness, climbed on the operating table, and I at once removed one lobe under nitrous oxide anæsthesia. She has finally recovered her health, and when last seen her pulse was 68 on sitting and only 80 after exertion—a complete transformation from

ing summary is taken from my records and, for the sake of comparison, the cases have been divided roughly into two groups, the grave and the moderate, in accordance with the clinical picture.

Highest of grave cases	55
Highest of moderate cases	38
Lowest of grave cases	15
Lowest of moderate cases	21
Average of grave cases	30.2
Average of moderate cases	27.6

From these it will be seen that the degree of lymphocytosis did not bear any constant relation to the severity of the case or to the prognosis. The condition of the myocardium has served for me as the most reliable guide.

The acute exacerbations, the explosions of hyperthyroidism, should be regarded as a positive contra-indication. A dilated heart, failure of compensation, poor muscular sounds, are the danger signals, and will determine whether operation must be deferred or altogether abandoned. Had I recognized this condition and observed this stricture, I would not have operated when I did on one of my two fatal cases.

The patient (File No. 10286) was forty years of age, the symptoms were only of six months' duration, the heart action was extremely irregular (*delirium cordis*) and the heart dilated, tachycardia was marked, the vessels of the neck pulsating, restlessness extreme, the urine contained albumin and granular casts, the legs were œdematous, and there was some ascites, the hæmoglobin was 75 per cent and there was a lymphocytosis of 27, respirations were rapid, and the thymus gland was enlarged. This was a case running an acute course, with a dilated heart, failure of compensation, chronic nephritis and an enlarged thymus. Both superior thyroid arteries were ligated under local anæsthesia preceded by scopolamine and morphine, the patient died 5 hours after the operation. This happened two years ago. To-day, the operation, if performed at all, would have been deferred until the patient's condition had improved, one instead of two vessels would have been ligated, nitrous oxide anæsthesia would have supplanted local, and anoci-association would have been included in the preparation.

In the non-toxic varieties, our technic comprises the Kocher collar incision, separation in the midline of the sternohyoid and thyroid muscles, the high division of one pair or the other, if necessary, the removal of one or one and a part of another, always leaving the posterior capsule *in situ* to avoid removal of the parathyroid glandules (subcapsular lobectomy). The muscular layers including the platysma are closed with interrupted catgut sutures, and the skin with horsehair

GOITRE AND HYPERTHYROIDISM

still favor the superior thyroid, because of the greater facility of including in the ligature not only the vessels but the nerves, a technical point of which Crile has explained the importance

Results—Of the 103 operations, there were 80 thyroidectomies with no deaths Of 3 thyroidectomies for malignant disease, there was

TABLE III

FINAL RESULTS IN 37 CASES PRESENTING TOXIC SYMPTOMS WHICH HAVE BEEN RECENTLY HEARD FROM

Pathological diagnosis	Entirely well	Greatly improved	Moderately improved	No improvement	Total
Non-hyperplastic-toxic (simple)	2	1	2		5
Non-hyperplastic-toxic (adenoma)	5	5	2		12
Hyperplastic toxic	5	7	1		13
Toxic cases in which ligation was performed	3	3	1		7
Total	15	16	6		37

one death, a sarcoma in a boy eleven years of age Of the 17 ligations, there were two deaths, both true exophthalmic goitres, one an acute case of six months' duration already referred to, the other a case in the terminal stage of the disease

TABLE IV

SYMPTOMS IMPROVED SINCE OPERATION IN 30 CASES RECENTLY HEARD FROM

Pathological diagnosis	Mental irritability	Palpitation	Ocular disturbance	Weight	Strength	Diarrhœa	Dyspnœa
Non-hyperplastic-toxic (simple)	4	2		4	4		3
Non-hyperplastic-toxic (adenoma)	9	9	1	7	7		2
Hyperplastic-toxic	11	9	10	10	10	4	7
Toxic cases in which ligation was performed	4	3	4	4	4	4	3
Total	28	23	15	25	25	8	15

The end results in the toxic cases were in accordance with those recorded from other clinics Of the patients heard from, 90 per cent had fully recovered or were greatly improved and of the latter a number had been operated upon within the last year The complete-

her former debilitated state This is an example of what I mean by the application of psychic influence in the treatment of Graves's disease, which unquestionably is a factor of great importance

With reference to the advantages of scopolamine in all cases, I have been a little skeptical At least in some cases it seemed to have a disturbing rather than sedative action In two cases particularly the pulse was accelerated, and the patients became extremely restless and in one instance delirious In this case, the operation was postponed because of this extreme excitation, at the time set for the operation two weeks later the scopolamine was omitted and this condition of excitation did not occur In most of the toxic cases and in all the more serious ones, nitrous oxide anæsthesia has been used, and I believe to advantage The choice of operation must be left to the individual judgment of the surgeon My rule has been to err always in favor of conservatism, to choose in doubtful cases ligation rather than lobectomy, one vessel rather than two, or in the more serious cases injection of boiling water rather than ligation While I have had no experience with the latter I am convinced from the reports of Porter (*Jour Mich State Soc*, February, 1913) of its usefulness The only two cases which died in the hospital as the result of operation were double ligation, and in looking over the records, I can clearly see the wisdom of substituting boiling water injections at least as a preliminary treatment for ligation I have practised ligation 17 times in 14 patients In 9 both superior arteries were ligated, in 3 the right superior, in 4 the left superior, and in 1 the left inferior Five patients were operated upon twice and one three times, as follows

First operation	Second operation	Third operation
1 Ligation right superior thyroid	Lobectomy	
2 Right lobectomy	Ligation left superior thyroid	
3 Ligation both superior thyroids	Ligation left inferior thyroid	Right lobectomy
4 Ligation both superior thyroids	Right lobectomy and ligation of left superior pole	
5 Ligation right superior thyroid	Ligation of left superior thyroid	
6 Ligation of both superior thyroids	Right lobectomy and ligation of left superior pole	

Halsted's (*Trans Am Surg Assn*, 1913) preference of ligation of the inferior over the superior thyroid artery deserves consideration, and while from the purely technical consideration and the cosmetic effects he has made out a strong case in favor of the inferior thyroid, I

CHRONIC CYSTIC MASTITIS*

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It would serve no useful purpose to review in detail the historical data concerning the progress of knowledge concerning chronic cystic mastitis. The attention of surgeons was first directed towards this disease particularly by Koenig, Reclus and Schimmelbush. About a decade ago, Greenough and Warren in this country published the results of their study upon a large series of cases. In this Academy, Speese and Taylor have reported series of cases and have paid particular attention to the relation of carcinoma to chronic cystic mastitis. Additional interest has recently been given to the subject by the publication of a clinical paper by Judd (*Jour Mich State Med Soc*, 1914, 1, p 11) and one by MacCarty (*Surg, Gynec, and Obst*, 1913, xvii, p 441) upon the pathology, both from the Mayo Clinic. It has seemed worth while to the writer to report the results of eighteen cases operated on in Dr. Frazier's clinic in the University Hospital in which the diagnosis of chronic cystic mastitis was made by the pathologist with occasional reference to the occurrence of epithelial hyperplasia. I have excluded those cases diagnosed as chronic cystic mastitis and carcinoma, they have been included with the cancers, and the early cases were reported to this Academy in 1909 by Dr. Speese (*ANNALS OF SURGERY*, 1910, 11, 213).

It is not necessary to discuss the changes occurring in the normal breast at the time of involution, nor is it necessary to dilate upon the fact that this disease is believed to be due to certain abnormal changes occurring at this time.

The term chronic cystic mastitis is open to certain objections and that this has been realized by various writers is evident by the fact that there are twelve synonyms for the disease, no one of which seems perfectly satisfactory.

When examined grossly these breasts show an increase in the fibrous tissue generally throughout the entire gland, but more dense in certain areas or about certain lobules. It varies from white to gray in color and in many cases is of cicatricial consistency. Cysts are present

* From the Service of Dr. C. H. Frazier in the University Hospital, Philadelphia. Read before the Academy of Surgery of Philadelphia, April 6, 1914.

ness of the cure does not depend entirely upon the successful removal of the gland. Two other factors must be considered: first, the care of the patients after the operation which should, whenever possible, free the patient from physical and nervous strain for periods varying from several months to two years. Unfortunately, the social status of the patient may make it impossible to provide these conditions sometimes. This must be borne in mind by the practitioner into whose hands the patient falls after operation, and the completeness of the recovery will depend upon his appreciation of the need of this after-treatment and whether the circumstances permit of its enforcement. Second, the existence of chronic visceral disease at the time of the operation must be taken into account. Some of these patients are physical wrecks with organic lesions of heart, kidney, and other organs, from which complete recovery is impossible. As Kocher (*Brit Med Jour*, February 17, 1912) has said, if all cases were operated upon within a short time after the outbreak of the disease, they would probably all be cured and to this might be added that the mortality, low as it now is in all cases, would be reduced to that of as common a procedure as herniorrhaphy.

The general practitioner has every right, if he so chooses, to try nonsurgical means in the early stages of the disease before the myocardium or kidney or nervous system is permanently damaged. But if he fails to arrest the disease and does not advise operation in the curable stage, he should be just as severely censured as the practitioner who fails to call for surgical aid until his patient with acute appendicitis has developed peritonitis, or one with a callous ulcer of the stomach, carcinoma. The conditions are quite parallel. The extraordinary recuperative power of patients with Graves's disease is amazing, and in most cases, sick as they are at the time of operation, they will almost uniformly be restored to perfect or reasonably good health.

CHRONIC CYSTIC MASTITIS

hyperplasia, while a growth in the right breast removed two years later was of the primary type. In another case the right breast was removed in 1904 and showed primary hyperplasia. Six years later a mass was removed from high in the upper outer quadrant, the remains of the breast, and showed a secondary hyperplasia. In two other cases the secondary type of hyperplasia was encountered. Of the four secondary hyperplasias, *ie*, the type which may or may not be carcinomatous according to MacCarty, three of the patients were traced and reported cured five years, four years, and three years, respectively, after operation. Of the ten primary hyperplasias, eight have been traced and all reported cured. The tertiary hyperplasias or carcinomas are not reported because we include them under the cancers.

While this series is entirely too small to draw important deductions, it is interesting to note that the average age at operation of the patients with primary hyperplasias was thirty-six, of the secondary hyperplasias, forty-one.

The clinical features of this disease are well known by most surgeons, although it has been my experience that most men in general practice have rather vague ideas upon the subject, and this cannot be wondered at considering the confused nomenclature and varied descriptions of the pathology. The malady affects the breasts of women at an average age of forty years, may involve one or occasionally both breasts, is associated with a certain amount of pain, occasionally referred down the arm, and upon examination a rather vague mass is felt, containing one or more hard nodules, and which is not adherent to the skin or to the underlying pectoral fascia. Examination of the axilla rarely reveals any enlargement of the nodes there. In Judd's recent paper he reports 218 cases of chronic cystic mastitis, eleven occurring in males, of which 85 per cent occurred during the "cancer age" (30 to 60 years). The greater number of cases gave a history of having had previous mastitis and nearly all of them complained of pain. In our series pain was the exception rather than the rule, and 89 per cent were between 30 and 60 years.

TABLE I
AGE INCIDENCE

	Cases
Between 10 years and 20 years	1
Between 20 years and 30 years	2
Between 30 years and 40 years .	5
Between 40 years and 50 years	9
Between 50 years and 60 years	1

in every case, occasionally in microscopic dimension only, but as a rule varying in size from a few millimetres up to several centimetres. They contain fluid varying in color from clear watery fluid through all shades of yellow and green up to black. Histologically, the fibrous tissue is found increased, especially that derived from the interlobular connective tissue, a round-cell infiltration is frequently observed, the large ducts are occasionally compressed, the acini in the lobules vary considerably in size and their lining epithelium shows various stages of proliferation. It is this variation in the epithelium which has given rise to much discussion and which at times suggests or indicates the histologic picture of cancer. To discuss the matter in the language of Greenough or of Warren we see two types of the disease, those in which the changes are distinctly cystic with flattened, atrophic epithelium and those in which proliferation is a characteristic feature with varying degrees of hyperplasia of the epithelium, even to the formation of adenomatous areas. MacCarty calls attention to the fact that the secretory cells of the primary acinus, composed of one row of columnar or cuboidal cells, rests upon another row of cells almost invisible in the normal breast but prominent when there is a chronic inflammatory reactive process present, and which corresponds to the so-called *stratum germinativum* of the skin and constituting the germinal cells of the epithelium of the breast. These will be referred to as the outer cells and the first mentioned as the inner cells. When both are present he terms the histologic picture a primary epithelial hyperplasia, the inner cells disappear and there remain only the hyperplastic cells of the outer row. This condition will be referred to as secondary epithelial hyperplasia, and he states that it may be frequently seen in chronic cystic mastitis and may or may not be malignant. When the cells of the outer row appear in the periacinal stroma, the condition may be spoken of as tertiary or migratory hyperplasia and is, of course, carcinoma. MacCarty believes that we should determine the percentage of cases of secondary hyperplasia which will remain well or will recur after the removal of the primary gland itself without the removal of the lymphatic gland, muscles and large amounts of skin.

I have examined the slides of 14 of our cases for the purpose of classifying them according to the MacCarty scheme. In nine the hyperplasia was of the primary type, *1e*, the growth was benign. In the tenth case the patient was operated on three times, twice in the left and once in the right breast, and in all three neoplasms primary hyperplasia only was found. In the eleventh case the mass in the left breast was excised subcutaneously and revealed the secondary type of

few days later. On the other hand, Judd from his experience with 218 cases reports that in 211 a conservative operation was performed and in none of the cases was there found evidence of malignant degeneration. In the remaining seven cases of doubtful malignancy the radical operation was performed. It is not stated in his report whether this examination was made from frozen section at the time of operation or whether it was made later, but both Judd and MacCarty state that in the experience of the Mayo Clinic the removal of the mammary gland preceding an immediate radical operation has not been associated with earlier recurrence than has been found after a primary radical operation. In the discussion (*ANNALS OF SURGERY*, 1910, 111, 253) before this Academy in 1910, Dr. Taylor stated that, as a rule, he would remove the whole gland in a case of carcinoma except that the muscle is allowed to remain unless the tissues of the breast appear macroscopically uncertain. Gibbon would practise complete removal only when the disease had existed for a long time, where there were multiple cysts or where there was recurrence, after operation. Ross removed the gland subcutaneously and Rodman was partial to Warren's operation if there were a competent pathologist at hand to make a frozen section report. The plan of treatment recently suggested by MacCarty deserves consideration. He believes that in the doubtful cases in women near or over thirty-six years of age, they should have the entire mammary gland removed for immediate examination. If primary or secondary hyperplasia be present nothing more should be done, if tertiary hyperplasia be present a radical operation should be performed. In doubtful patients near or under thirty-five years of age a wide section of the gland should be removed, and if primary hyperplasia be present nothing more should be done, if secondary hyperplasia be present the remainder of the gland should be removed, and if tertiary hyperplasia be present the radical operation should be performed. Judd slightly varies this procedure and advises, in women under twenty-seven years of age, partial excision preferably by the Warren method, in those between thirty and forty years he believes that the radical operation is the surest method but prefers for cosmetic reasons to practise partial excision and to abide by the decision of the pathologist, doing a radical operation at the time if necessary. In patients between the ages of forty and sixty a radical operation should be performed but the muscle need not be removed in definite benign conditions.

In our own series of cases, resection of a portion of the gland was performed seven times, in one of these the breast was completely amputated and the axilla dissected out because of apparent recurrence.

The youngest, fifteen years (male), the oldest, fifty years Average age, thirty-eight years, eight months Married, fifteen, single, two, male, one Ten had borne children, four were childless The menstrual history was of no importance in any case

In the family history the occurrence of cancer was noted in five instances, tuberculosis twice, and in one of these both tuberculosis and carcinoma were present in the family history Only two patients of the eighteen stated that they had injured the breast and both ascribed the mass to the injury In only one case was there a previous history of acute mastitis and in this patient there was also a history of trauma Four of the patients, at least, were ptotic

The duration of the disease was very variable and any statements on this point would be inaccurate because often the patient would state that the "lump" had been present for a few weeks or months when it probably had existed for a longer period One patient had only noticed the mass for three days and immediately came for operation Another had noted the mass for five years and still another stated that she had had masses in the breasts ever since she was a little girl

Of these 18 patients a definite, satisfactory letter has been received from 15, and in all of them cure has evidently occurred The period of cure varies from eight months to nine years and seven months and may be tabulated as follows

TABLE II
INCIDENCE OF CURE

	Cases
Eight months to three years	4
Three years to six years	5
Six years to ten years	6
Not traced	3

Treatment—In discussing the treatment of chronic cystic mastitis we are confronted by the statistics of 295 cases collected by Speese (ANNALS OF SURGERY, 1910, 11, 213) in which the diagnosis of cystic mastitis was made and the subsequent pathological examination revealed carcinoma in 15 per cent In 1910 Dr Taylor (ANNALS OF SURGERY, 1910, 11, p. 253) reported before this Academy 26 cases in which the diagnosis of chronic cystic mastitis had been made of which 50 per cent showed carcinomatous degeneration We are also confronted with the statement from the Johns Hopkins Clinic that if we remove a mass from the breast which upon microscopic examination turns out to be carcinoma, the patient will almost inevitably die within the three-year limit even though the secondary complete operation is performed a

INDICATIONS FOR AND VARIATIONS IN THE TECHNIC OF ECK FISTULA*

By MAX MINOR PEET, M.D
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FROM THE DEPARTMENT OF SURGERY AND THE JOHN HERR MUSSER DEPARTMENT OF RESEARCH MEDICINE,
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THE production of an artificial communication between the vena cava and portal vein for the relief of certain pathological conditions was first described by Eck in 1877 and therefore bears his name. He suggested the operation especially as a remedial measure in cases of cirrhosis of the liver with abdominal ascites. He never attempted the operation on man, however, as his mortality with animals was rather high. Numerous technics have since been elaborated, several of which are quite uniformly successful. Probably the best known of these is the one described by Carrel and Guthrie, which with slight modifications has been used in all our experimental work.

The operation has been performed twice on man. The first was by Vidal in France, the report of which he published in *La Semaine Medicale* in 1903. The patient had cirrhosis of the liver, and was apparently benefited by the operation, but died four months later from an "endovascular infection of enteric origin."

The second operation was performed by P. Rosenstein, who reports it in the *Zentralblatt für Chirurgie*, Leipzig, February 28, 1914. His case also had cirrhosis of the liver with marked ascites, necessitating frequent tapplings. He first tried omentopexy, but without gaining any relief. He next performed an Eck fistula operation which he says only gave temporary relief, tapplings having to be resumed a short time after. He next tried drainage into the urinary bladder through a valvular opening. This, he reported, gave almost complete relief. He does not describe his technic for the Eck fistula and it is very possible that the portal pressure was not sufficient to keep the anastomotic opening patent. We have observed this in dogs when the portal was not ligated above the anastomosis. It is also possible that the communication between the portal and vena cava was not sufficiently large. In one of our dogs this mistake occurred and when the animal was killed about

*Read before the Philadelphia Academy of Surgery, April 6, 1914.

two months later and we were fearful of carcinoma, no microscopic evidence of carcinoma, however, was found in either specimen, but unfortunately the patient has not been traced. In a second case the resection was followed two and a half years later by a subcutaneous excision of the entire breast for apparent recurrence. This patient returned a little later for a similar condition in the opposite breast which was also excised subcutaneously. She reports herself at the present time as being entirely well, and, curiously, on January 31, 1914, gave birth to a daughter, at which time the tissues over the chest were tender and there was a slight discharge from the nipple. Excision of the breast was performed in the remaining eleven cases, in one being accompanied by a dissection of the axilla, and in another a radical operation was done two years after the excision. Both these cases have been traced and are perfectly well. One patient who had both breasts operated on with a complete amputation on one side and a subcutaneous excision on the other much prefers the former operation, stating that the remaining nipple is quite tender.

I have called particular attention to these recent statements of Judd and MacCarty, because every one is familiar with the older literature and perhaps even the new does not offer anything in the way of progress. There have been a number of papers written upon malignant degeneration or carcinomatous changes in chronic cystic mastitis and Judd makes the statement that chronic cystic mastitis is a precancerous condition. No one has ever seen the direct transformation, however, and it is only by tracing the border-line cases, the secondary hyperplasias of MacCarty, that we are able to determine in just what cases a radical operation should be done and in which cases a conservative one performed. There is no reason why chronic cystic mastitis could not be produced by the pressure of the carcinoma cells together with the fibrous hyperplasia that always accompanied this disease, and therefore a result, not a cause, of the cancer. It may be coincident.

The two diseases are closely interwoven, however, and any tendency to conservative treatment in women over thirty years of age is to be deprecated.

In conclusion I wish to express my indebtedness to Dr. Frazier for permitting me to collect and report his cases as well as for the privilege of using his wards for my own patients and in some instances for operating on his patients. I have had six patients suffering from chronic cystic mastitis operated on in other hospitals and Dr. Frazier has had a number of cases in the Episcopal Hospital, but we have thought it best only to report the series in the University Hospital.

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three months afterwards, a marked dilatation of the vessels in the entire portal system with compensatory circulation was found, although the anastomosis was still patent. The opening practically always contracts to a certain extent and in his case, while it appeared sufficient at first, may have contracted below the physiological limit for adequate functioning. We have also observed this in our experimental animals. Several surgeons, especially in this country and in Italy, have opened the abdomen with the expectation of performing an Eck fistula, only to find the adhesions so dense around the hilus of the liver and the portal vein and vena cava that the operation could not be performed. Dr. Frazier and I recently opened an abdomen with the object of performing an Eck fistula, but the adhesions throughout the entire abdomen were so extensive that it was impossible to reach any of the larger veins.

Experimental work on dogs and cats has amply proved the procedure feasible, and that comparatively little danger exists in the operation itself. The animals remain healthy, usually gain in weight as normal animals should, and at least when on a normal mixed diet show no toxic symptoms whatever.

Indications for Eck Fistula—Cirrhosis of the liver with ascites, for which condition the operation was first devised, still offers the principal field for its employment. Those cases with an alcoholic history and without serious changes in other organs are probably the most favorable for this procedure. In those cases in which an attempt at compensatory circulation exists, shown by the so-called "caput medusæ" and by enlargement of the œsophageal and hemorrhoidal veins, the operation is particularly indicated, since the greatly enlarged veins, particularly in the œsophagus, are prone to rupture at any time. This is so often fatal that indications for its relief completely overshadow those for the simple improvement in the ascites. The operation of Eck's fistula offers, at least theoretically, the most promising relief for the impending œsophageal hemorrhage, in fact offers the only immediate relief from danger. But it would be much better to operate in the early stages, when ascites is the only complaint, than to wait for the most serious of the sequelæ.

The Talma-Morison operation of epiploexy or omentopexy offers in the early stages of hepatic cirrhosis a simple method for the relief of ascites and in many cases has afforded marked improvement, some even claiming a cure of the ascitic condition. It is certainly a question in the early stages, which operation, epiploexy or Eck's fistula, should be the choice. The mortality from the former has been very high, but

principally, I think, because it was performed too late in the disease, considerable shock resulting from the extensive irritation of the peritoneum. The mortality from the Eck fistula operation should be small, especially if done early, as there is actually very little trauma to the peritoneum. The two cases in which it was performed suffered no ill effects from the procedure. Omentopexy affords very little relief in the late stages when the oesophageal varices have formed, so that in this condition we can offer little hope except by an artificial, direct anastomosis between the portal and caval systems.

Cirrhosis due to stasis in the hepatic veins, so-called nutmeg liver, the liver of chronic congestion, is often associated with ascites, but in this case neither omentopexy nor Eck fistula could be expected to afford relief since the trouble lies, not in the portal, but in the vena cava itself. The pressure in the latter is so high that stasis occurs in all its tributaries, and the flow through the portal is more or less dammed back. These cases are usually associated with marked valvular lesions in the heart and no surgical procedure except drainage of the ascites can be offered.

In Banti's disease we apparently have a primary splenomegaly with a secondary cirrhosis of the liver. In this condition Eck fistula should give complete relief from the portal obstruction and resulting ascites. A fourth class of patients which could be materially helped by Eck fistula are those suffering from thrombophlebitis of the portal vein. The etiology of this condition varies considerably, but probably most cases are due to syphilis and to primary or secondary cryptogenic pyogenic infections. The vein shows a phlebosclerosis upon which thrombi form, more or less occluding the lumen. Occasionally complete obstruction occurs and unless canalization soon takes place the portal obstruction proves fatal. The splenic veins are also involved in many of these cases. Indeed, Warthin considers this the primary factor in the etiology of Banti's disease. Obviously, the classical Eck fistula operation could not be done in these cases, since the portal may be more or less diseased for the greater part of its length. In this class of cases we would make the anastomosis between one of the larger mesenteric veins and the vena cava or if more convenient on one of the common iliacs. Certainly omentopexy in this condition could not be expected to give the relief which a modified Eck fistula would afford.

Those cases of ascites due to nephritis or serious cardiac lesions would not be benefited by either omentopexy or Eck fistula, repeated tappings or drainage into the parietal tissues being the only surgical measure advisable.

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THE TECHNIC OF ECK FISTULA

principally, I think, because it was performed too late in the disease, considerable shock resulting from the extensive irritation of the peritoneum. The mortality from the Eck fistula operation should be small, especially if done early, as there is actually very little trauma to the peritoneum. The two cases in which it was performed suffered no ill effects from the procedure. Omentopexy affords very little relief in the late stages when the oesophageal varices have formed, so that in this condition we can offer little hope except by an artificial, direct anastomosis between the portal and caval systems.

Cirrhosis due to stasis in the hepatic veins, so-called nutmeg liver, the liver of chronic congestion, is often associated with ascites, but in this case neither omentopexy nor Eck fistula could be expected to afford relief since the trouble lies, not in the portal, but in the vena cava itself. The pressure in the latter is so high that stasis occurs in all its tributaries, and the flow through the portal is more or less dammed back. These cases are usually associated with marked valvular lesions in the heart and no surgical procedure except drainage of the ascites can be offered.

In Banti's disease we apparently have a primary splenomegaly with a secondary cirrhosis of the liver. In this condition Eck fistula should give complete relief from the portal obstruction and resulting ascites. A fourth class of patients which could be materially helped by Eck fistula are those suffering from thrombophlebitis of the portal vein. The etiology of this condition varies considerably, but probably most cases are due to syphilis and to primary or secondary cryptogenic pyogenic infections. The vein shows a phlebosclerosis upon which thrombi form, more or less occluding the lumen. Occasionally complete obstruction occurs and unless canalization soon takes place the portal obstruction proves fatal. The splenic veins are also involved in many of these cases. Indeed, Warthin considers this the primary factor in the etiology of Banti's disease. Obviously, the classical Eck fistula operation could not be done in these cases, since the portal may be more or less diseased for the greater part of its length. In this class of cases we would make the anastomosis between one of the larger mesenteric veins and the vena cava or if more convenient on one of the common iliacs. Certainly omentopexy in this condition could not be expected to give the relief which a modified Eck fistula would afford.

Those cases of ascites due to nephritis or serious cardiac lesions would not be benefited by either omentopexy or Eck fistula, repeated tappings or drainage into the parietal tissues being the only surgical measure advisable.

Technic of Eck's Fistula.—A simple method for lateral venous anastomosis which did not involve an exposure of the opened vessels was described by Sweet in 1904. In his method a posterior row of sutures approximating the portal and vena cava is laid, similar to the posterior row in a gastro-enterostomy. Two needles bearing a fine platinum wire are then passed through the lumen of the vessels from above downwards, the position of the wire determining the location and size of the anastomotic opening. The anterior layer of sutures is then placed, completely closing, except at the lower end where the wire emerges, the space through which the anastomosis will be made. The wire is then connected to a special holder and an electric current passed through it. Careful traction is now made, and the wire, acting as a cautery, rapidly cuts a communication between the two veins. When the wire emerges at the lower opening a very little blood escapes, which is immediately controlled by tying the last suture. This effectually closes the lower opening.

Bernheim in 1912 published a technic quite similar. Instead of employing the electric cautery he used a special type of scissors armed with a guard. Previous workers, including Eck and Pawlow, have used practically the same method, with the exception of the guard on the scissors. Bernheim claims that with these special guarded scissors it is impossible to injure the outer walls of either vein, and the size of the cut can be made with mathematical exactness.

It is interesting, when we consider that in this operation no attempt, other than the exclusion of the air, is made to prevent clotting, that no thrombus occurs. The volume and rapidity of the blood stream seem to be sufficient to prevent any accumulation of erythrocytes upon the thin layer of fibrin which always forms on the cut edges. This is one factor strongly in favor of the operation on man, since it minimizes the greatest danger of the operation, that of thrombosis.

The operation as described by Carrel and Guthrie is essentially as follows. The vena cava and portal vein are isolated, their lumens closed above and below the site of anastomosis by ordinary serrafins, spring-jawed clamps or tape, and an incision made in each vessel, parallel with its longitudinal axis. Guthrie states that "the openings in the vessels should be in width about one-third the diameter of the vessel, and in length about one and one-half times the diameter of the vessel." But it is usually not necessary to actually cut away any of the vessel wall, the natural contraction of the circular fibres after the longitudinal incision allowing sufficient width. It is, however, essential that the openings in the corresponding veins should be the same size.

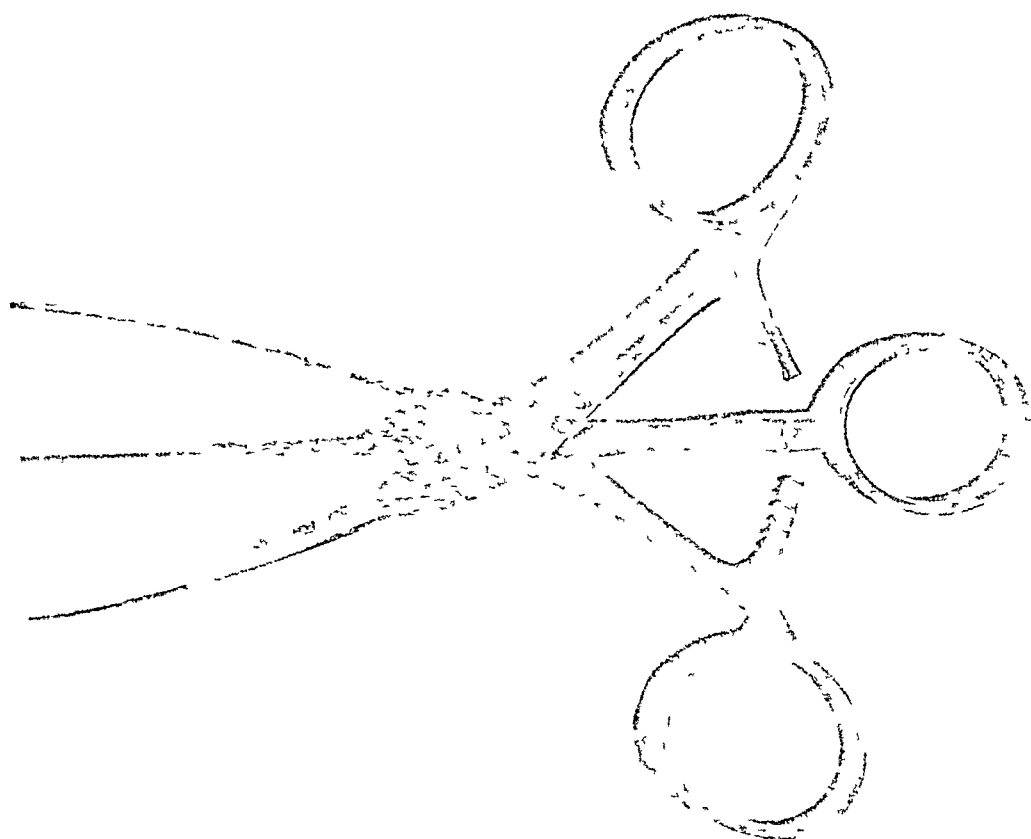


FIG 1 —Author's three bladed spring jawed blood-vessel clamp opened

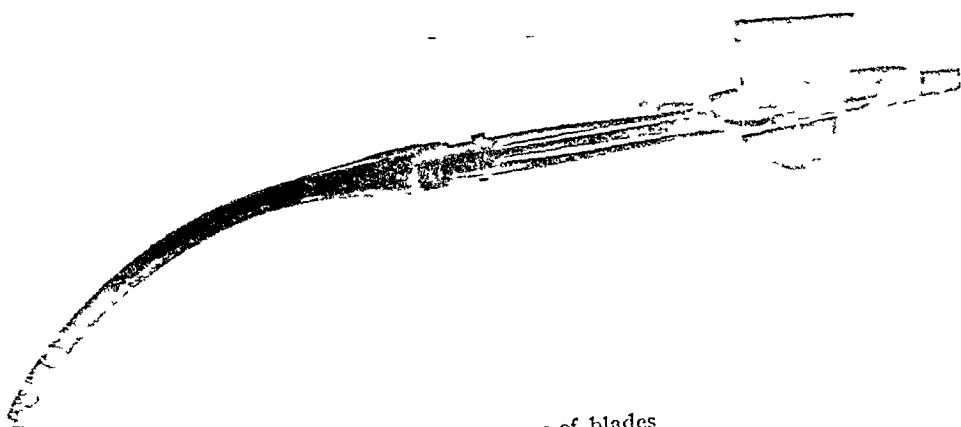


FIG 2 —Showing curve of blades

THE TECHNIC OF ECK FISTULA

and shape, else considerable difficulty will be experienced in their proper approximation. The isolated portion of each vessel is thoroughly washed out with liquid vaseline. Two stay sutures are then placed, one at each end of the oval openings, so that the vessels are accurately approximated, the knot of the suture being outside in the angle formed by the two vessels. A third suture may be placed through the two posterior walls for traction, but should not be tied. One of the stay sutures then re-enters the vessel through its wall and a continuous over-hand suture joins the posterior edges. It is then passed through the vessel wall and tied with the second stay suture. The anterior wall is closed in a like manner. Very fine straight needles with 000 silk are used, and the stitches should be placed about one-half millimetre from the cut edge and about one-half to one millimetre apart.

The modifications in this technic which we adopted consisted only in the manner of procuring temporary hæmostasis and in the type of needle used. To do away with the time-consuming isolation of the vessels which consisted in freeing them for the entire length of the clamped-off portion, the clamping or tying of their tributaries and the application of the four serrafins, we used, after the first few operations, a pair of curved spring-jawed forceps designed by Dr. Sweet. These are practically diminutive intestinal clamps. It was found advisable to cover the blades with gauze or cotton cloth to prevent their slipping from the veins. These forceps are easily and quickly applied by simply raising the vessel with the fingers and clamping it lengthwise, the curve of the blades and their length giving ample room for the incision. Since difficulty was sometimes experienced in maintaining the parallel position of the two clamps I had a three-bladed clamp made which resembles the ordinary gastro-enterostomy clamp except in size. The application of this clamp is very simple. The portal and vena cava are lifted with the fingers and caught between their respective blades. We have found this clamp perfectly satisfactory in animal work.

The other modification of Carrel's technic was in the use of curved needles instead of straight. We had the Kirby No. 16 needles shortened by about half and curved. The sutures could thus be much more easily placed, especially near the ends of the opening.

The variation in the above technic necessitated by different pathological conditions consists only in the choice of vessels used. When the portal is thrombosed or otherwise diseased, or when adhesions prevent access to the upper vena cava, it will be found perfectly possible to make the anastomosis elsewhere. Normally, in the human a large mesenteric vein is found lying just above the common iliacs. If

the mesenteric vein is not of sufficient length to be easily approximated to the iliac the former may be ligated near the mesenteric base, divided, and turned downward. We have performed this modification on the dog and found it satisfactory. In the same way the mesenteric vein could be anastomosed to the lower vena cava. If an operator should fear to use the iliac, I think it would be possible to bring up the saphenous vein, as is sometimes done for drainage of ascites, and anastomose the mesenteric vein to it.

Conclusions—From a rather extensive use of the Eck fistula in dogs we consider the operation safe, entirely compatible with a normal life, and simple of execution. We prefer the modification of Carrel's technic.

In cases of liver cirrhosis with ascites and in cases of thrombosis or other obstruction to the portal circulation, we consider the operation advisable, especially so where œsophageal varices exist. In the latter condition, at least, it should prove much superior to omentopexy.

BIBLIOGRAPHY

- 1877 N V Eck *Militär-medizinisches Journal*, 1877, cxxx, Jahrgang, 55
- 1879 N V Eck Also in *Travaux de la Soc des Naturalistes de St Petersburg* (*Bulletins de la Section Zoologique*), 1879, x
- 1882 Stolnikow "Die Stelle vv hepaticarum im Leber- und gesammten Kreislaufe" *Pflüger's Archiv für die gesammte Physiologie*, 1882, xxviii, 255
- 1892 Hahn, Massen, Nencki, et Pawlow "La fistule d'Eck de la veine cave inferieure et de la veine porte et ses consequences pour l'organisme"
1 Partie physiologique, par MM Massen et Pawlow 2 Partie chimique, par MM Hahn et Nencki *Archives des sciences biologiques de St Petersburg*, 1892, 1, 401
- 1893 Hahn, Massen, Nencki, et Pawlow Also in "Die Eck'sche Fistel zwischen der unteren Hohlvene und der Pfortader und ihre Folgen für den Organismus" *Archives f exp Path u Pharm*, 1893, xxxii, 161
- 1893 Pawlow, J P "Sur une modification dans l'operation de la fistule d'Eck entre la veine porte et la veine cave inferieure" *Archives des sciences biologiques de St Petersburg*, 1893, 11, 581
- 1893 Kothar "Contribution a l'etude du rôle du foie comme organe defensif contre les substances toxiques" *Archives des sciences biologiques de St Petersburg*, 1893, 11, 587
- 1894 Markuse "Über die Bedeutung der Leber für das Zustandekommen des Pankreasdiabetes" *Zeitschrift für klin Med*, 1894, xxvi, 225
- 1895 Querolo "Ueber die Function der Leber als Schutz gegen Intoxication vom Darm aus" *Moleschott's Untersuchungen zur Naturlehre des Menschen und der Thiere*, 1895, xv, 228
- 1895 Nencki Footnote in regard to the method of Querolo, in *Maly's Jahresbericht über die Fortschritte der Thierchemie*, 1895, xxv, 310

- 1895 Hédon et Delezenne "Effets des injections intraveineuses de peptone après exstirpation du foie combiné à la fistule d'Eck" *Compt rend de la Soc de Biol*, 1895, xlviii, 633
- 1895 Montuori "Sull'importanza del fegato nel diabete pancreatico" *Gazz d Osped ed clin*, 1895, No 10.
- 1896 Magnamini "La modificazioni del ricambio azotato dopo l'innesto della vena porto colla vena cava inferiore" *Il Policlinico*, 1896, iii, 153
- 1896 Magnamini "Les modifications de l'échange azoté apres qu'on a mis la veine porte en communication avec la veine cave inferieure" *Arch ital de biologie*, 1896, xxvi, 66
- 1896 Schupfer "Sugli effete che induce nell' organismo l'innesto della vena porta nella vena cava inferiore per rispetto all' autointossicazioni di origine intestinale" *Il Policlinico*, 1896, iii, 357
- 1896 de Filippi "Nota sul ricambio materiale dei cani operati di fistula Eck" *Riforma med*, 1896, xii (vol iv), 243
- 1896 Nencki, Pawlow et Zaleski "Sur la richesse du sang et des organes en ammoniacque et sur la formation de l'urée chez les mammiferes" *Archives des sciences biologiques de St Petersburg*, 1896, iv, 191
- 1897 Nencki und Pawlow "Zur Frage uber den Ort der Harnstoffbildung bei den Saugethieren" *Archiv f exp Path u Pharm*, 1897, xxxviii, 215
- 1897-1898 L Popielski "Ueber das Schicksal des Zuckers bei Hunden mit Eck'scher Fistel" *Bolnitschnaja gaseta Botkina*, 1897, No 46 Also *St Petersburg med Wchnschr*, 1898, xxiii, 2
- 1898 Nencki, Pawlow und Zaleski "Ueber das Ammoniakgehalt des Blutes und der Organe und die Harnstoffbildung bei den Saugethieren" *Archiv f exp Path u Pharm*, 1898, xxxviii, 26
- 1898 Doyon and Dufourt "Effets de la ligature de l'arterie hepatique et de celle de la veine porte" *Arch de physiol norm et path*, x, pp 522-37, 1898
- 1898 Salaskin, S "Ueber das Ammoniak in physiol und patholog Hinsicht und die Rolle der Leber im Stoffwechsel stickstoffhaltiger Substanzen" *Zeitschrift fur physiologische Chemie*, 1898, xxv, 449
- 1898 Salaskin, S "Ueber die Bildung von Harnstoff in der Leber der Saugethiere aus Amidosauren der Fettreihe" *Ibid*, p 128
- 1898 Bozzi "Alterazioni anatomopatologiche nei cani operati di fistola di Eck" *Bologna*, 1898
- 1899 v Karltru Demonstration und Mittheilung uber die Vereinigung der unteren Hohlvene mit der Pfortader (Eck'sche Fistel) *Wiener klin Wochenschrift*, 1899, xii, 205
- 1899 de Filippi "Recherches sur l'échange material des chiens operes de fistule d'Eck Contribution a l'étude de la physio-pathologie du foie" *Archives ital de biologie*, 1899, xxxi, 211
- 1900 Salaskin und Zaleski "Ueber den Einfluss der Leberexstirpation auf den Stoffwechsel bei Hunden" *Zeitschrift fur physiologische Chemie*, 1900, xxix, 516
- 1900 Bozzi "Ricerche sperimentali dirette a studiare i rapporti possibili fra intestino, fegato e reni" *Firenze*, 1900
- 1901 Nencki and Zaleski *Zeitschrift f physiol Chem*, xxx, p 193, 1901

- 1901 v Karltru "Ueber die Vereinigung der unteren Hohlvene mit der Pfortader" Arch f exp Path u Pharm, 1901, xlv, 56
- 1901 Strauss "Zur Funktions Prufung der Leber" Deutsche med Wochenschr, 1901, 757, 786
- 1902 Tansini "Ableitung des portalen Blutes durch directe Verbindung der V portae mit der V Cavae Neues operatives Verfahren" Centralblatt fur Chirurgie, 1902, xxix, 937
- 1902 Biedl and Winterberg Beitrage zur Lehre von der Ammoniak-entgiftenden Function der Leber" Arch f d ges. Physiol, lxxxviii, 1902, p 140
- 1903 Schulz and Muller "Klinische, physiologische und pathologische-anatomische Untersuchungen um einen Fall von hochgradigen Ascites bei Pfortaderthrombose' Deutsches Arch f klin Med, 1903, lxxxvi, 544
- 1903 Vidal La Semaine Medicale, p 351
- 1905 Hawk, P B A study of the conditions following the establishment of the Eck Fistula in dogs American Journal of Physiology, 1905, xiii, Proceedings, 14
- 1905 Sweet, J E "The artificial anastomosis between the portal vein and the vena cava inferior—Eck's Fistula" Jour of Exper Med, vii, No 2, April 25, 1905
- 1905 MacLeod and Haskins "Contributions to our knowledge of the Chemistry of Carbamates" Jour Biol Chem, 1905, i, p 319
- 1905 Rothberger and Winterberger "Ueber die Giftigkeit der Fleischnahrung bei Hunden nach Ausschaltung der Leber aus dem Portalkreislauf (Eck'sche Fistel)" Arch internat de physiol, ii, pp 140-141, 1905
- 1906 Carrel and Guthrie Uniterminal and biterminal venous transplantations Surg, Gyn and Obstet, 1906, ii, 266 Also "L'anastomose des Vaisseaux sanguins par la methods du 'patching' dans la transplantation du rein" C R de la S de B, 1906, lxi, 276, ibid, ix, 1104
- 1907 Carrel, A "The Surgery of the Blood-vessels, etc" Johns Hopkins Hosp Bull, January, 1907
- 1907 Sweet, J E, and Levene, P A "Nuclein Metabolism in a dog with Eck's Fistula" Jour of Exper Med, ix, No 2, March, 1907
- 1907 de Filippi "Der Kohlehydratstoffwechsel bei Hunden, die mit Eckscher Fistel, nach der Pawlowschen Methode (direckte Einfuhrung des Pfortablutes in die Vena cava mit Unterbindung der Pfortader) operiert wurden Ztschr f. Biol, 1907, xlix, 511
- 1908 de Filippi "Der Kohlehydratstoffwechsel bei mit der Eckschen Fistel Pawlowscher Methode (direckte Einfuhrung des Pfortaderblutes in die Vena cava mit Verschluss der Pfortader aus Leberhilus) operierten Hunden" Ztschr f Biol, 1908, i, 38
- 1908 Hawk "On a series of feeding and injection experiments following the establishment of the Eck Fistula in Dogs" Amer Jour Physiol, 1908, xxi, 259
- 1909 Voegtlin and King J Biol Chem, 1909, xi, Proceedings
- 1909 Whipple and Sperry "Chloroform Poisoning, Liver Necrosis and Repair" Johns Hopkins Hospital Bull, 1909, xx, 278

THE TECHNIC OF ECK FISTULA

- 1909-1912 Matthews, S A "The effects of Eck fistula on the liver (dog's)"
Trans Chicago Path Soc, 1909-12, viii, 263-266
- 1910 Guthrie "Survival of Engrafted Tissues—III Blood-vessels" Heart,
1910, 11, 115
- 1911 Bernheim, B M, and Stone, H B "Lateral Vascular Anastomosis"
ANNALS OF SURGERY, October, 1911, p 496
- 1911 Abel and Macht "The Poisons of the Tropical Toad, Bufo Aqua"
Jour Amer Med Assoc, 1911, lvi, 1531
- 1911 Frouin, A "Nouvelle technique de la fistule d'Eck" Presse med,
Paris, 1911, xix, 976, 980
- 1911 Frouin, W, and Jeanne, P "Nouvelle technique de la fistule d'Eck"
Compt rend Soc de biol, Paris, 1911, lxx, 954-956
- 1911 Fischler, F "Weitere Mitteilungen zu den Beziehungen Zwischen
Leberdegenerationen und Pankreasfettgewebsnekrose an Tieren mit
Eckscher Fistel und über die Möglichkeit ihre Verhütung" Deutsches
Arch f klin Med, ciii, p 156, 1911 Ibid, civ, p 300
- 1911 Grafe and Fischler Ibid, civ p 319, 1911
- 1911 Michaud "Über den Kohlenhydratstoffwechsel bei Hunden mit Eckscher
Fistel," Verhandlungen d Kongr f innere Med, 1911, xxviii, 561
- 1911 Voegtlin and Bernheim The rôle of the Portal circulation of the liver
in bile formation and jaundice Jour Pharm and Exper Ther,
1911, 11, 455
- 1912 Towles and Voegtlin "Creatine and creatinine metabolism in dogs
during feeding and inanition with especial reference to the function
of the liver" Jour Biol Chem, 1912, x, 479
- 1912 Bernheim, B M, and Voegtlin, C "Is the anastomosis between the
portal vein and the vena cava compatible with life?" Johns Hopkins
Hosp Bull, Baltimore, 1912, xxiii, 46-49, 1 pl
- 1912 Guthrie, Charles C "Blood-vessel Surgery and its Applications" Univ
of Pittsburgh, December, 1911
- 1912 Fischler und Bardach "Über Phosphorvergiftung am Hunde mit
partieller Leberausschaltung" Zeitschr für Physiologische Chemie,
lxxviii, 1912
- 1912 Rosenstein, Paul "Über die Behandlung der Leber-cirrhose durch
Anlegung einer Eckschen Fistel" Archiv f klin Chir, 1912, xcvi,
p 1082
- 1912-1913 Jeger, E "Die Operationstechnik der Eckschen Fistel" Internat
Beitr z Path u Therapy d Ernährungsstoffwechs u Verdauungskr,
Berl, 1912-13, iv, 1-9
- 1913 Fischler und Kossow "Vorläufige Mitteilung über den Ort der Aceton-
körperbildung usw. Deutsch Archiv f klin Med, cx1, 1913, 479
- 1913 Hassan, Reschad, and R duBois-Reymond "Zur Technik der Eckschen
Fistel" Archiv für Anatomie und Physiologie, 1913, 325-328
- 1913 Bernheim, B M "Surgery of the Vascular System" Baltimore, 1913
- 1914 Rosenstein, P "Autodrainage of Ascites into the Bladder" (Ventil-
bildung an der Harnblase zur Ableitung der Ascitesflussigkeit) Zen-
tralblatt für Chirurgie, Leipsic, Feb 28, 1914, xli, No 9, pp 369-416

ONE HUNDRED AND TEN CONSECUTIVE CASES OF APPENDICITIS WITHOUT MORTALITY *

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THE cases which are the subject of this report were operated at the Long Island College Hospital, with two exceptions, either by the author, his associate, Dr James Watt, or by a member of the House Staff, in their presence and under their direction. Every form of the disease is represented in this group. We have adopted the usual classification, dividing the cases under the four heads, catarrhal, relapsing, suppurating and gangrenous appendicitis. Many of our cases are drawn from a poor neighborhood and were sent to us long after the indications were clear for operative interference. There are 16 cases of the catarrhal variety, 42 relapsing, 36 suppurating and 16 gangrenous. Nine patients were ten years old, or younger. One woman was sixty-eight years old and one man seventy-six. Appendicitis is most common with us at the time when epidemic influenza is rampant, and at the time of the so-called summer diarrhoeas. The method adopted of treating these cases has been to operate in every case as soon as the diagnosis was made and the patient and operating room prepared. We have regarded the call to a case of appendicitis as taking precedence over any and all engagements whether of a social or professional character. Many of these cases have been operated late at night or in the small hours of the morning, not from choice but because the patients were first seen late by us. We have allowed no case to go over to the following day when any active symptoms were present, because we have learned that we are unable to determine to our satisfaction what is going to take place inside the belly and we feel that the patient will gain nothing by waiting. The preparation is very simple. The abdomen is shaved dry. A dose of scopolamine and morphine is given forty-five minutes before the time set for the operation. For the emergency cases no attempt is made to move the bowels, excepting one low enema. When vomiting is active the stomach is washed, the patient is anæsthetized on the operating table in a room provided for that purpose. We use either gas, oxygen and ether, or ethyl chloride and ether. As soon as the patient is unconscious, he is brought to the operating room and his skin pre-

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APPENDICECTOMY WITHOUT MORTALITY

pared with iodine We use the low McBurney incision in the large majority of cases, extending it as we find necessary The mesentery of the appendix is found and ligated at once if possible The appendix is isolated, crushed near its base and ligated with catgut A purse-string suture of catgut is then passed around the base of the appendix in the cæcum The appendix is removed either by cautery or scissors, cutting between the ligature and a clamp The stump is turned in, the purse-string suture drawn tight and tied The mesentery is tied over the stump wherever possible In a small proportion of our cases, we are able to carry out this procedure without putting a finger inside the abdomen, or getting our gloves soiled with a drop of blood We have many times removed the appendix from the base toward the tip when this procedure seemed indicated The wound is closed in layers We use clips for the skin

When an abscess is found we isolate it with gauze pads, make a very gentle search for the appendix, and remove it in a large majority of cases It was deemed wise not to remove the appendix in two cases of this series Both cases made a good convalescence and neither has returned for further treatment

In the gangrenous cases the appendix is always removed and an attempt is made to suture a piece of mesentery or fat over the cæcum

When free pus is present with extensive peritonitis, it is sponged out whenever seen One or two long straight retractors are then passed into the pelvis and the patient tilted to the right side This procedure sometimes enables us to remove several ounces of pus, without passing sponges into the pelvis This is all done rapidly and gently by the operator and no attempt is made to investigate further One or more drains are placed in position and the wound partially closed We never irrigate or put peroxide or ether, or any other chemical in the abdomen Our drains are made of soft rubber tubing or iodoform gauze, covered with green gutta-percha tissue which is wrapped around the tube or gauze, projecting beyond the end No rubber tubing or gauze is left in contact with the intestines No one but the operator is allowed to put his hand or finger inside the abdomen The assistants often end an operation with their gloves as clean as when they started The cases with marked vomiting and all cases with free pus and extensive peritonitis have the stomach washed in the operating room as soon as the binder is put on We have been fortunate in having no case of thrombosis in this series of cases We have seldom recognized the Lane kink as a pathological condition Most of our patients are placed in the Fowler position at once followed by hypodermoclysis when indi-

cated The Murphy drip is used in a large proportion of cases One dose of a quarter of a grain of morphine is given if pain is severe and may be repeated with a second dose of an eighth of a grain We endeavor to give our patients a comfortable night following operation Nothing is allowed by mouth, even water, for twenty-four hours in the severe cases, and nothing by mouth in any case for twelve hours No morphine is allowed after drink or food is taken by mouth We use the rectal tube as a routine measure, but find that it accomplishes very little After thirty-six or forty-eight hours, the patients receive a low enema If that is satisfactory, no further attention is paid to the bowels for twenty-four hours, when one dose of three grains of calomel and ten grains of bicarbonate of soda are given, followed in half an hour by Seidlitz powder Our main standby in the bad cases is the stomach tube At the first sign of regurgitation of bile or dilatation of the stomach or continued vomiting, or even hiccough, the stomach is washed out until the water turns clear A large dose of calomel is given and gastric lavage repeated at the first indication of a return of the untoward symptoms In one case this was carried out eight times in twenty-four hours

We realize that we have been fortunate in having so large a series of cases recover, but we believe also that we have learned something from our past mistakes and from the successful experience of others We believe that our results in these cases are due in part to the consistent plan illustrated by the following rules

First, operate as soon as the diagnosis is made

Second, make a sufficiently large incision Use the greatest gentleness in handling tissues within the abdomen and stop operating as soon as the absolutely necessary work is done

Third, use the Fowler position, Murphy drip and hypodermoclysis

Fourth, use the stomach tube persistently and intelligently

There has been considerable interest in medical economics of late It may be worth while to state that 45 of these patients paid nothing for hospital care or professional services, 65 paid the hospital, and only 17 of the 110 paid anything for professional services

ABSTRACT OF CASE HISTORIES

S H, age nineteen, catarrhal, one previous attack

L S, age sixty-eight, suppurating, three distinct previous attacks This patient had suffered from digestive troubles for many years, all of which are relieved

R P, age twenty-three, relapsing, one previous attack

A H, age thirty, relapsing, two previous attacks The patient had a small ulcer on anterior wall of stomach which was turned in and sewed over A year

APPENDICECTOMY WITHOUT MORTALITY

later it was necessary to do a pylorectomy for a large indurated gastric ulcer occupying the site of the original lesion of the stomach

F D, age twenty-five, relapsing, one previous attack.

S, age thirty-one, suppurating, extensive peritonitis, two drains, one previous attack There was an extensive peritonitis with a large amount of free pus The appendix had ruptured at the base, fecal fistula developed which lasted thirty-one days

A S, age fourteen, gangrenous, one previous attack, no drainage

R S, age ten, gangrenous, three previous attacks, no drainage

M J, age twenty-three, suppurating, one previous attack Patient had been sick in bed four days before coming to hospital

R G, age ten, suppurating, extensive peritonitis, two drains, no previous attacks This boy fell on a picket fence, causing a penetrating wound in the perineum and a slight contusion on the lower right side of the abdomen The day following the accident he was seized with typical symptoms of appendicitis and at operation a suppurating appendix with several ounces of free pus was found

S M, age twenty-six, suppurating, no previous attacks

R V, age fifteen, catarrhal, one previous attack

B C, age eight, suppurating, extensive peritonitis, two drains, a large retrocæcal appendix removed

M H, age thirty-two, relapsing, marked discomfort for six years, which prevented the patient from carrying on her vocation as a nurse

F W, age sixteen, gangrenous, no previous attacks Patient had been vomiting pretty constantly for twelve hours before operation

V D N, age twenty-two, relapsing

N B, age twenty-four, relapsing

J M, age twenty-eight, gangrenous, no drains Many previous attacks

H L, age twelve, relapsing

R H, age twenty-five, gangrenous, one drain All pain referred to region of gall-bladder which was found normal, but a large retrocæcal appendix was removed

M M, age twenty-four, gangrenous, two drains, retrocæcal position, very free bleeding Mikulicz drain

L B D, age twenty-three, gangrenous, two previous attacks

D M, age thirty-four, gangrenous, extensive peritonitis Mikulicz drain

M O N, age twenty-one, gangrenous, peritonitis, two drains

M W, age thirty-four, relapsing, many previous attacks A large Riedel's lobe Patient made very slow convalescence

G D R, age twenty-nine, gangrenous, peritonitis, two previous attacks This patient was seized with his third attack while in his office He recognized the condition, got a taxi, drove directly to the hospital, took a room and asked for the first available surgeon

B. W, age forty, relapsing

I F, age thirty, catarrhal This patient suffered from abdominal cramps and constipation commencing six months after the operation and growing gradually worse About one year after her operation I saw her with her New York physician and found that she was suffering from acute intestinal obstruction She was hurried around the corner to the New York Hospital where Dr. Gibson dis-

cated The Murphy drip is used in a large proportion of cases One dose of a quarter of a grain of morphine is given if pain is severe and may be repeated with a second dose of an eighth of a grain We endeavor to give our patients a comfortable night following operation Nothing is allowed by mouth, even water, for twenty-four hours in the severe cases, and nothing by mouth in any case for twelve hours No morphine is allowed after drink or food is taken by mouth We use the rectal tube as a routine measure, but find that it accomplishes very little After thirty-six or forty-eight hours, the patients receive a low enema If that is satisfactory, no further attention is paid to the bowels for twenty-four hours, when one dose of three grains of calomel and ten grains of bicarbonate of soda are given, followed in half an hour by Seidlitz powder Our main standby in the bad cases is the stomach tube At the first sign of regurgitation of bile or dilatation of the stomach or continued vomiting, or even hiccough, the stomach is washed out until the water turns clear A large dose of calomel is given and gastric lavage repeated at the first indication of a return of the untoward symptoms In one case this was carried out eight times in twenty-four hours

We realize that we have been fortunate in having so large a series of cases recover, but we believe also that we have learned something from our past mistakes and from the successful experience of others We believe that our results in these cases are due in part to the consistent plan illustrated by the following rules

First, operate as soon as the diagnosis is made

Second, make a sufficiently large incision Use the greatest gentleness in handling tissues within the abdomen and stop operating as soon as the absolutely necessary work is done

Third, use the Fowler position, Murphy drip and hypodermoclysis

Fourth, use the stomach tube persistently and intelligently

There has been considerable interest in medical economics of late It may be worth while to state that 45 of these patients paid nothing for hospital care or professional services, 65 paid the hospital, and only 17 of the 110 paid anything for professional services

ABSTRACT OF CASE HISTORIES

S H, age nineteen, catarrhal, one previous attack.

L S, age sixty-eight, suppurating, three distinct previous attacks This patient had suffered from digestive troubles for many years, all of which are relieved

R P, age twenty-three, relapsing, one previous attack

A H age thirty, relapsing, two previous attacks The patient had a small ulcer on anterior wall of stomach which was turned in and sewed over A year

RECENT TRAUMATIC DISLOCATIONS OF THE HIP*

WITH A REPORT OF TEN CASES AND THEIR END RESULTS

BY CARL R. STEINKE, M.D.
OF PHILADELPHIA, PA

DURING the 9 years from February, 1905, to February, 1914, at the Episcopal Hospital of Philadelphia, 10 cases of recent traumatic dislocation of the hip were admitted out of some 23,000 surgical cases, 6000 of which were classified as surgical injuries, making approximately 1 dislocated hip to every 600 surgical injuries. For the privilege of reporting the following cases I am indebted to Drs Frazier, Davis, Deaver, Neilson and Mutschler, under whose services they were admitted.

CASE I—M M, male, age twenty, admitted February 21, 1907 (file No 619). The patient was admitted with a history of having had a large amount of coal fall upon him. On examination a high posterior dislocation of the left hip was found. The leg was adducted, inverted and flexed. Pain, tenderness and rigidity were noted about the hip. The patient was placed on a table face down, the knee and thigh were flexed and direct traction made downward while an assistant guided the head of the femur by pressure on the great trochanter, thus reducing the luxation (Stimson method). Five days later the patient was discharged in good condition.

Diagnosis—High posterior luxation of the left hip. At the time this article was prepared no trace of the patient could be found.

CASE II—T S, male, age fifty (?), admitted October 15, 1907 (file No 2846). The patient had jumped from a third-story window and was brought to the hospital in an unconscious condition. There was a fracture of the skull and through the middle third of the left femur. The head of the right femur could be felt anterior just below Poupart's ligament. The luxation was easily reduced by circumduction. The next day the pulse became weak and irregular and Cheyne-Stokes respiration was present. The respiration and pulse gradually became weaker and he died on the eighteenth, three days after admission.

Diagnosis—Fractured skull and left femur, and dislocation (pubic), anterior, of right hip.

CASE III—J V, male, age forty-five, admitted June 28, 1909 (file No 1610). He had been thrown from a crane, dislocating his right femur, the head being felt close to the sciatic notch. After reduction sand bags were placed on either side of the affected thigh. On the eleventh day he was up and about with no pain in the hip, so was discharged the next day.

* Read before the Philadelphia Academy of Surgery, April 6, 1914

the left side of the abdomen and of obstinate constipation No diagnosis has been made of present condition

W D, age twenty-eight, suppurating, several previous attacks

F U, age twenty-four, suppurating, several previous attacks

R R, age twenty-five, relapsing, many previous mild effects

A S S, age seventy-five, gangrenous, local peritonitis, no drain Patient has suffered with symptoms of duodenal ulcer for twenty-five years Made an excellent recovery With one exception, a man of seventy-seven, this is the oldest patient I have operated for this disease His attack was very acute and the gangrenous appendix was removed eighteen hours after his first symptom

J McG, age thirty, relapsing, the appendix was large, kinked and contained two large concretions, symptoms extend over three years

N S, age sixteen, catarrhal

H P L, age nineteen, suppurating, extensive peritonitis, drainage, no previous attacks This young man returned home from Princeton with a temperature of 103° and a pulse of 120, without realizing that he was particularly ill

J W, age thirty, suppurating, drainage, free pus, appendix not removed, wound healed Patient has not reported recently, but had no symptoms after six weeks

T L, age nineteen, relapsing, three previous attacks and retrocæcal position of appendix

S D, age twenty-five, relapsing, two previous attacks, retrocæcal position

A M, age thirty-five, relapsing, almost constant pyloric spasm over a period of two years, symptoms relieved by alcohol

C A, age eight, catarrhal

J G, age twenty-six, gangrenous, no drains, two previous attacks

B D, age twenty-eight, relapsing, one previous attack This patient was hurried in from her home on Long Island and operated on late at night on account of her serious symptoms The appendix was enlarged and contained pus, but its condition did not correspond to the patient's symptoms All symptoms, however, disappeared after operation

C H, age thirty, suppurating, three previous attacks, drainage, free pus

M K, age twenty-seven, relapsing

B D, age twenty-eight, relapsing, one previous attack

R D M, age twenty-seven, suppurating, no drain Patient eight months pregnant. Transferred to maternity ward, normal delivery at full term

A T, age seventeen, suppurating, extensive peritonitis, three drains, large quantity of free pus This case is the most marked example of the fulminating form of the disease in this series of cases

A W, age twenty-eight, suppurating, drainage, local peritonitis, several previous attacks

B P, age twenty-six, relapsing Patient six months pregnant, went through to term, normal labor

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Diagnosis—Posterior (sciatic) luxation of the right hip No further history of the patient obtainable

CASE IV—J M, male, age fifty-five, admitted April 19, 1910 (file No 5094) The patient was admitted with a posterior dislocation of the right hip The right thigh was flexed on the abdomen and adducted, while the knee was flexed and the foot turned in He was unable to extend the thigh either by force or voluntarily, but could flex it on the abdomen The great trochanter was felt anterior to its normal position and not prominent The head of the femur could be felt in the sciatic area and could be felt to rotate with the thigh Under ether anæsthesia the leg was flexed on the thigh and the thigh on the abdomen in adduction followed by outward circumduction and extension The head of the femur was felt and heard to snap back into its normal position Sand bags were placed on either side of the thigh There was tenderness about the right hip for a week, otherwise he was in good condition Four weeks later he was up and around, the hip being slightly painful, but he walked about on crutches He was discharged on the forty-sixth day in good condition

Diagnosis—Posterior (sciatic) luxation of right hip March 23, 1914, four years after the accident, he was working and found no disability from his dislocated hip

CASE V—B S, female, age thirty-eight, admitted February 9, 1911, (file No 473) One week previous to admission, while attempting to cross the railway tracks, the patient was struck by the tender of an engine, the engine and fire box passing over her, causing severe bruises, a fracture through the middle third of the right clavicle and a dislocated hip The left foot was inverted and rested on the instep of the opposite foot and the head of the left femur could be palpated between the acetabulum and the crest of the ilium The following day under gas and ether anæsthesia the luxation was reduced by the Allis method Buck's extension with 10 pounds was applied Three weeks later the left hip-joint was not particularly painful and showed no tendency of recurrence The clavicle showed good union with slight deformity She was discharged in care of the family physician

Diagnosis—Posterior (iliac) luxation of left hip

In a letter from her physician January 24, 1914, three years after the accident, he says concerning her hip condition "She has disability of the left leg due to the dislocated hip and fractured pelvis, and numbness and loss of power due to nerve injury from deep laceration of the thigh" It would seem her present condition is probably not due so much to the dislocation as to the nerve injury received at the time of the accident

CASE VI—H K, male, age twenty-eight, admitted June 7, 1912 (file No 1834) The patient fell from a 10-foot fence and was immediately brought to the hospital The left leg was normal The right leg was flexed and fixed in internal rotation, while the foot lay in inversion and the head of the femur could be felt on the flaring wing of the ilium There was great pain when the leg was moved and some laxity of the iliotibial band Under chloroform anæsthesia the luxation was reduced by flexion,

RECENT TRAUMATIC DISLOCATION OF THE HIP

traction, external circumduction and extension. The right leg then measured $\frac{1}{4}$ inch longer than the left. The next day there was aching pain in the affected hip but he could invert the foot and evert the toes fairly well. On the ninth day the general motion of the hip was fairly free and he was allowed to be about on crutches. Discharged 3 days later, walking on crutches with no limitation of motion and no shortening of the right leg.

Diagnosis—Posterior (iliac) luxation of right hip. X-ray No 2527 showed reduction of dislocation. The last of March, 1914, he was reported to be in good health and had a good functional result in his right hip.

CASE VII—B. L. S., male, age sixty-one, admitted January 23, 1913, (file No 319). In jumping from a third-story window to the ground he caused dislocation of the right hip. The right thigh, well in the position of flexion and internal rotation, could not be brought into full extension. Measuring from the anterior superior spines to the internal malleoli gave $1\frac{1}{4}$ inches shortening of the right leg. The base of Bryant's triangle on the right was $\frac{1}{2}$ inch shorter than the left. With the right thigh flexed the trochanter was felt $1\frac{1}{2}$ inches above the Roser-Nelaton line. There was an area of tenderness on the level of the anterior superior spine and about 5 inches from it on the right. Reduction by the Stimson method (as in Case I) attempted for 11 minutes. The deformity was improved but the luxation not reduced. The following day the X-ray No 5243 showed the hip still luxated. The patient being anesthetized was placed in the supine position on a hard mattress on the floor, and the thigh flexed on the pelvis to a right angle and leg at right angles to the thigh. With traction upward, internal and external rotation of the thigh, together with pressure on the trochanter, the head of the femur was brought into position in the acetabulum. Buck's extension applied with light weights. Two weeks later the patient was in good general condition, and at the end of the third week the weights and straps were removed, making him much more comfortable. Starting at the end of the fourth week he was gradually allowed to remain out of bed for longer intervals and there was no notable deformity of the leg. On the forty-seventh day he was discharged in good condition as cured.

Diagnosis—Posterior luxation of right hip.

In a letter from the patient just one year after the accident (January 22, 1914), he says "I run, hunt, climb ladders, skate, and am able to work in the fields of my farm." This is sufficient evidence that he suffers no ill effects from the dislocation.

CASE VIII—W. B., male, age twenty-six, admitted May 8, 1913 (file No 1803). A cart load of coal was dumped, striking him in the middle of the thigh, covering him with coal, and he had to be lifted on to a stretcher. He complained of pain in the right hip-joint and inability to walk. Examination. The head of the right femur palpated posterior and high up above acetabular rim. The right leg was flexed, inverted and shortened. Ether anesthesia given and the dislocation reduced by the Allis method. Discharged one week later as cured.

Diagnosis—High (iliac) posterior dislocation of right femur.

He went to work in three weeks' time March 21, 1914, ten and a half months after the accident, his hip was in good condition, having no pain at all, and he could go up and down stairs as well as before the accident

CASE IX—F McL, male, age thirty-five, admitted December 8, 1913 (file No 4974) While working on a roof a heavy gust of wind struck the man, causing him to fall 15 feet He was brought to the hospital and on examination the left leg was found to be normal The right leg was flexed, slightly abducted, and appeared lengthened, while the thigh was flexed and could not be straightened The foot was not everted, probably due to the position of the pelvis On movement there was severe pain and the head of the femur seemed to be dislocated, but the exact position could not be located, due to the rigidity of the adductors, a large area of ecchymosis was present on the posterior surface of the thigh and there was marked swelling With the patient standing on the left leg the right was found to be in the position of abduction with the thigh flexed, knee flexed, and the toes resting on the floor in eversion (Fig 1) X-ray No 8722 showed an anterior luxation of the right hip Plate No 275a shows the hip after reduction The patient was placed on a hard mattress on his back and ether given An assistant held the pelvis by downward pressure on the anterior superior spines while the right leg was flexed to a right angle on the thigh and the thigh at right angles to the body By strong traction upward, together with manipulation of the leg producing slight internal and external rotation of the thigh, and at the same time having pressure made on the great trochanter, the femur head was returned to its normal position with a snap that could be both heard and felt (Fig 2) The patient was then put to bed with sand bags, one on either side of the affected limb The following day there was still some pain in the hip but the leg was in good position On the tenth day after reduction the sand bags were removed and the patient allowed to go about on crutches Two days later he was discharged in good condition, walking on crutches

Diagnosis—Anterior (thyroid) dislocation of the right hip When seen March 23, 1914, he had returned to work and his hip was as good as before

CASE X—J G, male, age ten, admitted January 22, 1914, having been knocked down by an automobile Being unable to walk he was brought to the hospital where a dislocation of the right hip posteriorly was found The right leg was short, adducted and everted, the right foot resting on the heel of the left foot There was limitation of motion of the right hip and the head of the femur was felt posterior to the acetabulum Ether was given and the luxation reduced by flexion and traction, the head felt to slip into the acetabular cavity Sand bags were placed on each side of the thigh X-ray No 9437 shows the head to be in its normal position after the reduction On the sixteenth day the sand bags were removed and 2 weeks later he was discharged in good condition

Diagnosis—Posterior luxation of the right hip

When seen March 23, 1914 (2 months after the accident) he was running about playing with the other boys and had no pain or disability

FIG 1 —Case IX Showing anterior luxation of right hip

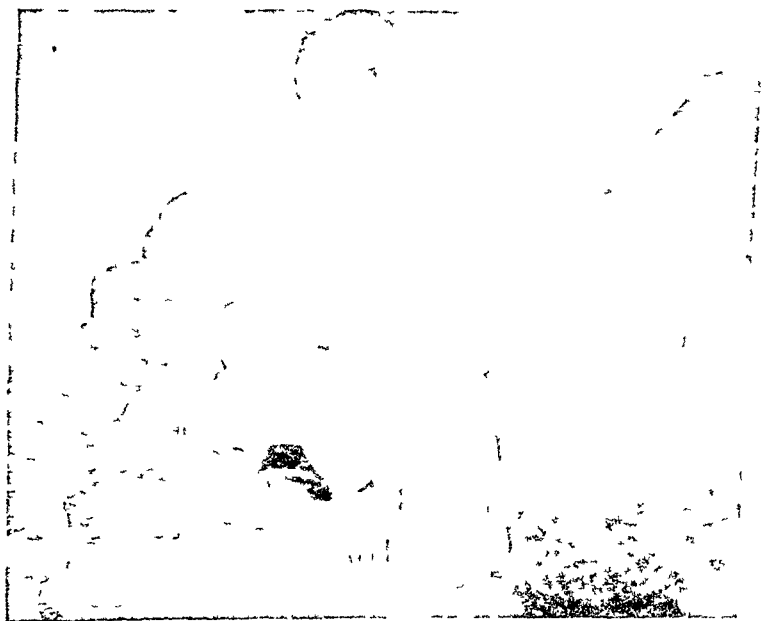


FIG 2 —Showing method of reduction (direct) in Case IX

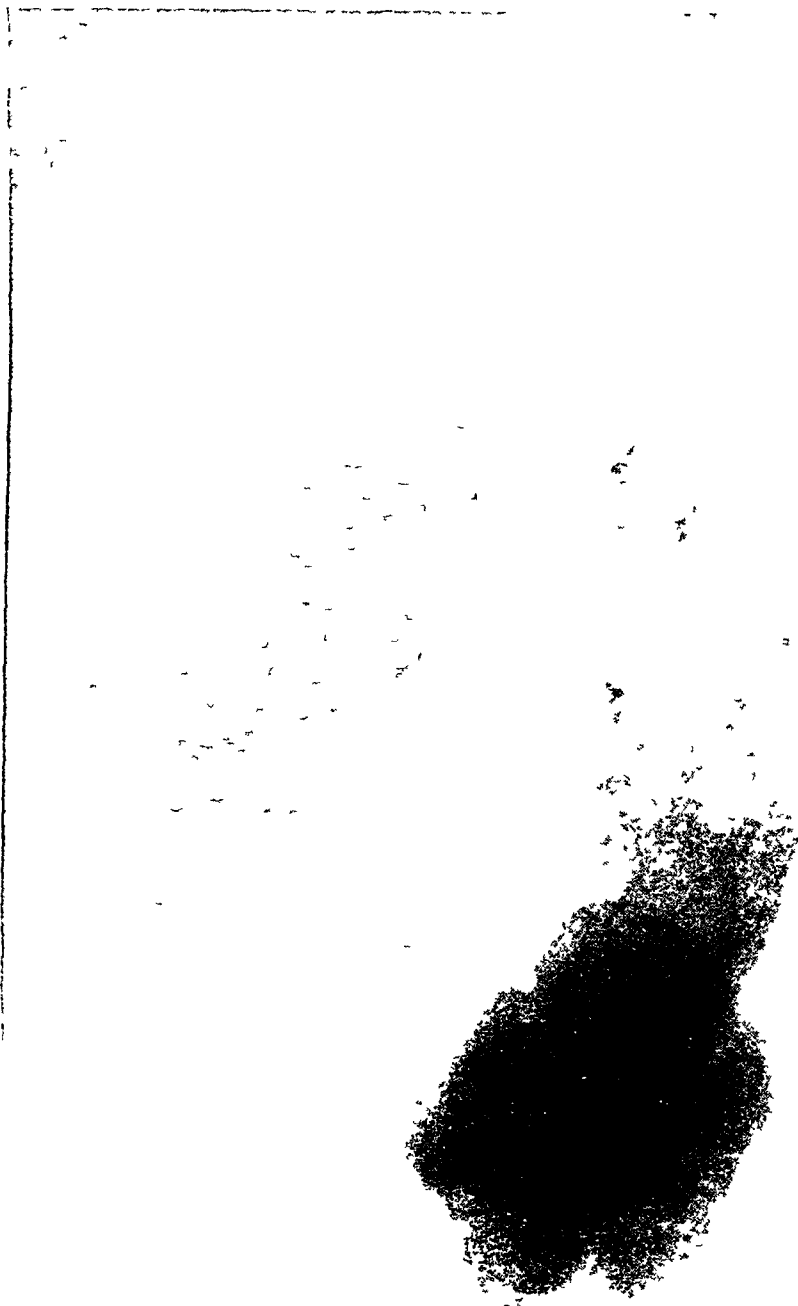


FIG 3 —Case VII X-ray No 5243 Showing dislocation of right hip (posterior)

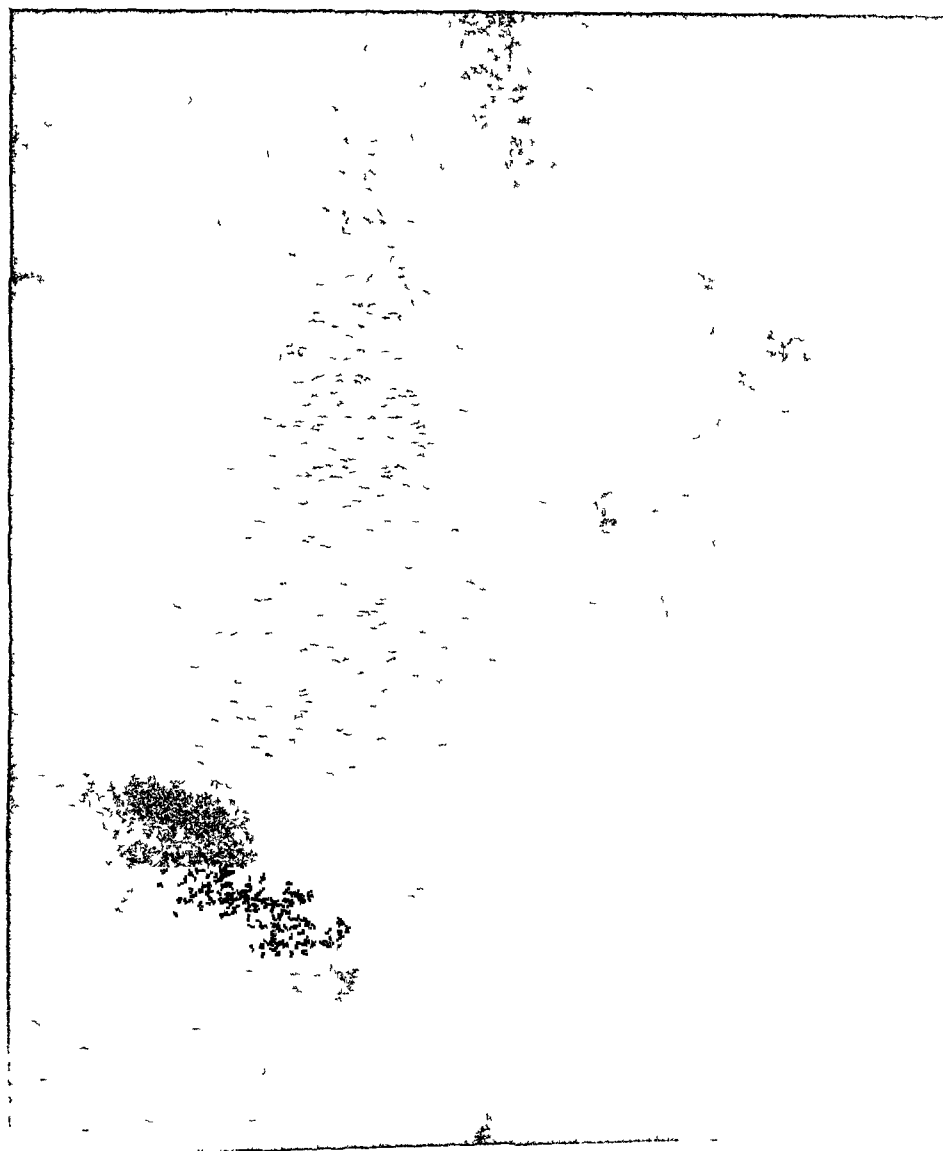


FIG 4—Case IX X-ray No 8722 Showing anterior dislocation of femur (right)



FIG 5 —Case IX X-ray No 257a Showing femoral head in position after reduction

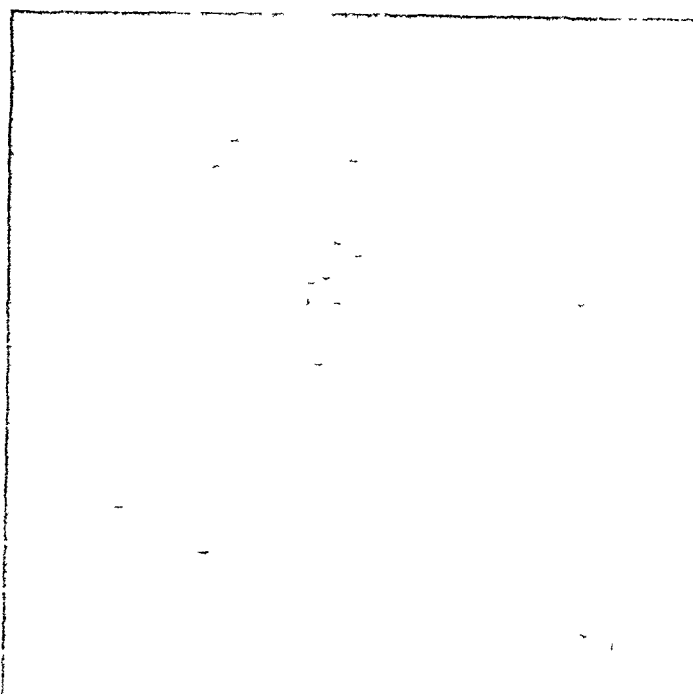


FIG 6 —Case X X-ray No 9437 Showing femoral head in normal position after reduction

RECENT TRAUMATIC DISLOCATION OF THE HIP

In the above series of cases there are 9 males and 1 female; the age ranges from 10 to 61 years, and the time in the hospital varies from 3 to 47 days. As to the types of dislocation there were 2 cases of anterior, 1 each of the pubic and thyroid variety, and 8 posterior cases, 4 being iliac or high, 2 sciatic, while 2 are simply given as posterior. This series confirms the statistical records as to the greater frequency of the posterior type.

There were several methods of reduction used and each proved efficient, except in one case when the Stimson method was employed unsuccessfully for eleven minutes. In one case the method was not stated. The indirect method was used once, circumduction twice (although from the description it may have been the indirect with a wide circle of the knee), and the direct 6 times, one of which was accomplished in the Stimson position.

The mode of treatment following the reduction varied. Four cases were simply kept in bed, 2 had Buck's extension applied for a time following the reduction, and the remaining 4 were kept in bed with a sand bag on either side of the affected leg.

At the time this paper was prepared 8 of the cases could be traced, one died of a fractured skull while in the hospital, another was reported as having numbness and loss of power of the leg, due not only to dislocation of the hip but to fracture of the pelvis and nerve injury as well, the remaining 6 cases are reported as being in good health with no disability from the previously dislocated hip, the time since the accident varying from 2 months to 4 years. With such a record it is concluded that simple luxation of the hip when properly reduced should give no impairment of function.

LITERATURE

- Stimson. *Treatise on Fractures and Dislocations*, 7th Ed, 1912, Lea, New York, p 797.
Cooper, Sir Astley. *Treatise on Dislocations and Fractures of Joints*, Blanchard and Lea, Philadelphia, 1851, p 74.
Chace, A. *New York Med Jour*, 1912, xcvi, 171-172.
Allis and Roberts. *ANN SURG*, Phila, 1911, liv, 371-380, also, *Trans Amer Surg Soc*, Phila, 1911, xxix, 94.
Davis, G G. *Applied Anatomy*, 2nd Ed, 1913, Lippincott, Phila, pp 512-513.
Davis. *loc cit*.
Stimson. *loc cit*, p 817, also, *New York Med Jour*, August 3, 1889.

THE SIGNIFICANCE OF THE JACKSON VEIL *

BY DANIEL N EISENDRATH, M D.

AND

E. W. SCHNOOR, M D

OF CHICAGO, ILLINOIS

At the 1912 meeting of the Western Surgical Association the discussion as to the true significance of the Jackson veil or pericolic membrane showed that the question was far from being solved. A committee composed of Drs D N Eisendrath, J Rilus Eastman and Howard N Hill was appointed to furnish the Fellows of the Association with blanks in order to note their findings at operation and to report the same at the 1913 meeting.

The principal phases of the present symposium should be, according to my conception of the question, (a) whether the membrane or veil described by Jackson in his first paper¹ is always a pathological structure, (b) whether it is always a normal structure, or, finally, (c) whether it is a normal, *i e*, a developmental, membrane, which may undergo pathological changes and give rise to conditions which cause clinical symptoms.

The committee asked each Fellow to report his observations in as concise a manner as possible, and, as chairman of the committee, I shall open the subject for discussion by a report of my observations (a) in the living, during operation, (b) in the human cadaver, and (c) in the human foetus. We have noted our findings in 25 cases operated on during the last four months at the Michael Reese Hospital. All of these were subjected to operation on account of symptoms of acute or chronic appendicitis, with the exception of Case 25, which will be described separately in Group 4.

A CLINICAL OBSERVATIONS

As a matter of convenience one can divide the observations made during operations into four groups as follows

- 1 The membrane corresponds in every detail to the normal parieto-

* This article is the report of the Chairman of the committee and was read before the Western Surgical Association at St Louis, December, 1913

¹ Surgery, Gynecology and Obstetrics, September, 1908

THE SIGNIFICANCE OF THE JACKSON VEIL

colic fold of the foetus or adult cadaver, even though there is ptosis of the cæcum

2 The membrane is thicker and less vascular than in Group I, and may cover a portion of the cæcum and appendix

3 The pericolic membrane (parietocolic fold) fuses at its lower border with the fold of Treves, or the two membranes (parietocolic and Treves) are present separately

4 The parietocolic fold has undergone pathological changes with resultant kinking or the production of a double-barrelled shot-gun deformity of the ascending colon (Fig 23)

Group I (See Fig 1) —These cases (15 in number) all showed

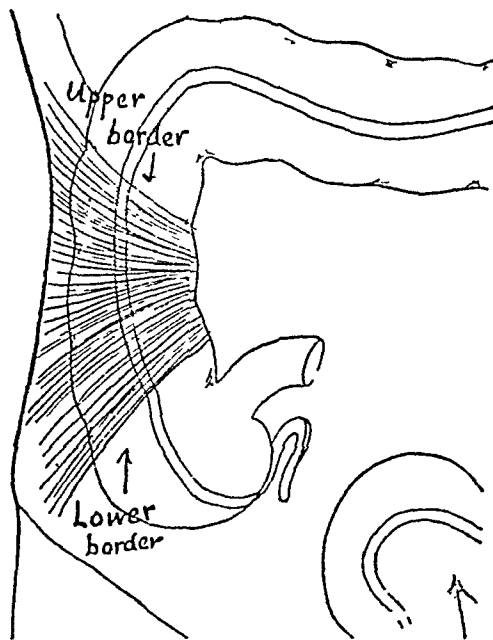


FIG 1—Sarah M., aged eighteen. Chronic appendicitis. Upper border at hepatic flexure, lower border one inch above end of cæcum. Not very vascular membrane extending across colon (ascending) to fuse with mesocolon on inner (mesial) side.

a fine, veil-like, translucent membrane, which was reflected from the parietal peritoneum, and then passed across the front of the ascending colon, ending gradually at the anterior longitudinal band in some cases, while in others it extended across the entire front of the ascending colon, either fusing with the peritoneum of the mesocolon or with the omentum near the hepatic flexure. The upper and lower borders could be readily picked up, the upper being at the level of the hepatic flexure and the lower from 1 to 1½ inches above the termination of the cæcum. In one case, the cæcum and ascending colon were so mobile that the cæcum and appendix (Fig 2) were found quite loose on the right side of the true pelvis, between the bladder and the lateral pelvic wall.

Even in this case the membrane, although much longer than when the cæcum was in the right iliac fossa, showed the same upper and lower borders and other characteristics of the pericolic membrane. Age seems to make no difference in the distribution and other features, except that the membrane seems a little more vascular in early life. The ages in this first group varied from 12 to 28 years. In none of these cases had any angulation of the cæcum or ascending colon oc-

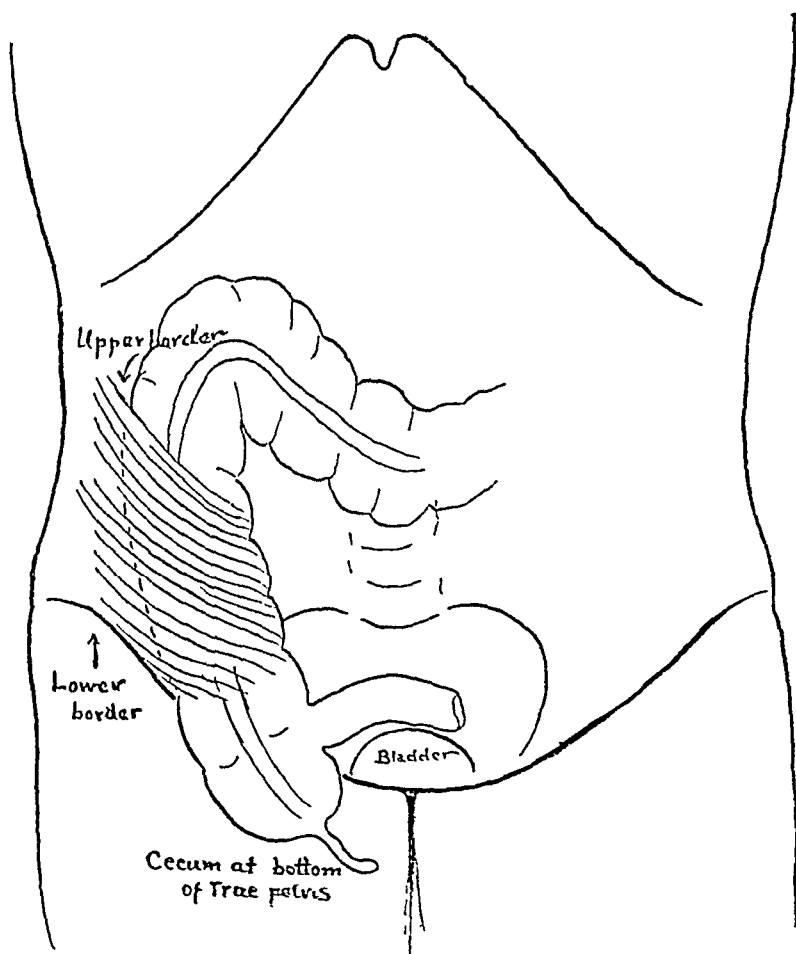


FIG. 2.—June 1, aged twenty-eight. Chronic appendicitis. Ptosis of cæcum and ascending colon into true pelvis. Cæcum and appendix lying at bottom of true pelvis. Typical pericolic fold with upper border at hepatic flexure and lower just above cæcum.

curred. The condition of the appendix amply explained the clinical symptoms. The mobility of the cæcum exerted no influence upon any of the characters of the membrane. In none of these cases was the membrane disturbed. In some the membrane showed many fibrous strands, and deposits of fat. Drs. L. A. Greensfelder and D. N. Eisendrath have found the membrane with the above upper and lower limits in over forty children, ranging in age from 2 to 12 years who were

THE SIGNIFICANCE OF THE JACKSON VEIL

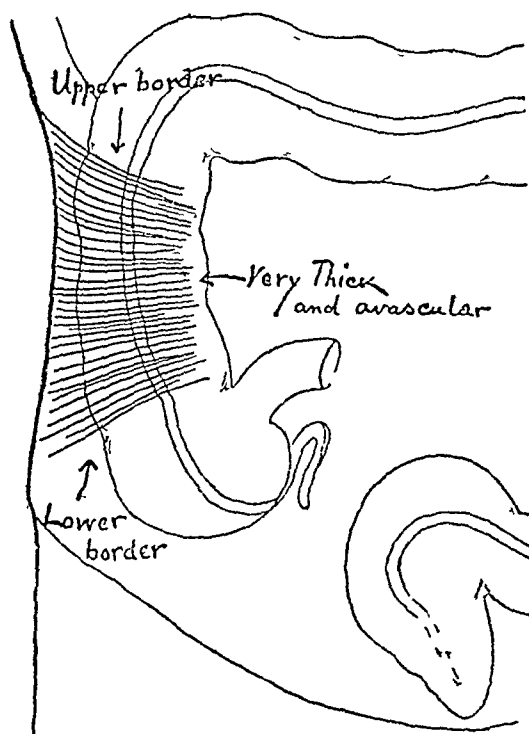


FIG 3—Herman E, aged fifty-seven Tuberculous peritonitis, evidently primary of appendix or cæcum Pericolic fold had typical upper and lower limits but was avascular, one inch in thickness, and studded with milary tubercles Upper border at hepatic flexure and lower border $1\frac{1}{2}$ inches above end of cæcum

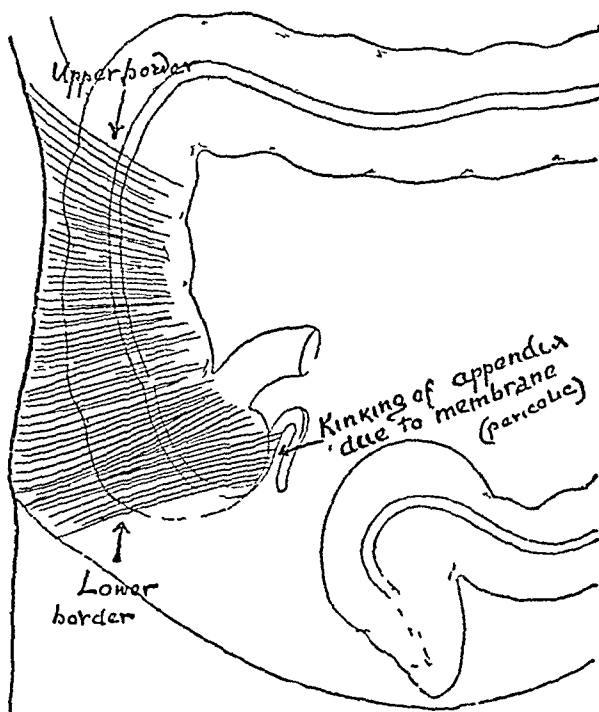


FIG 4—Esther B, aged eighteen Acute appendicitis Upper border of pericolic fold at hepatic flexure Appendix folded upon itself close to cæcum by extension of pericolic fold downward over proximal third of appendix, causing kinking of appendix, which was greatly enlarged and inflamed distal to the kink

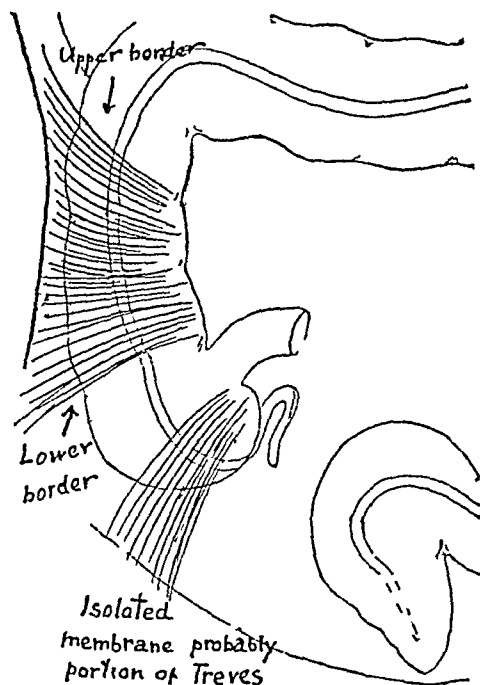


FIG 5—Jennie M, aged twenty. Chronic appendicitis. Cæcum very movable. Pericolic fold, upper border at hepatic flexure, lower border $1\frac{1}{2}$ inches above end of cæcum, extends entirely across ascending colon. A fine membrane (probably part of a fold of Treves) covered cæcum at its lower end.

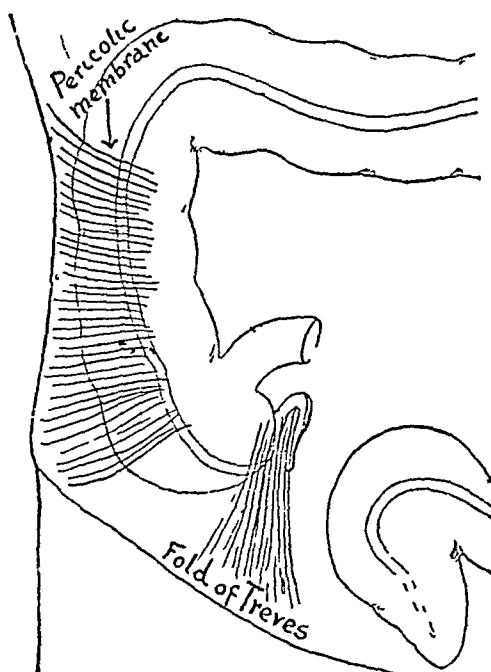


FIG 6—Harvey S, aged twenty-five. Chronic appendicitis. Upper limit of pericolic fold at hepatic flexure. Membrane extremely vascular and thick in places, fibres directed downward and inward and extends across ascending colon to anterior longitudinal band or slightly beyond it. Separated one-half inch at lower end from fold of Treves, which is well marked and forms several pockets.

THE SIGNIFICANCE OF THE JACKSON VEIL

operated upon for appendicitis at the Sarah Morris Children's Hospital.

Group 2—In two cases (Fig 3), one operated on for a general peritonitis due to a perforated appendix, and the other a case of tuberculous peritonitis, the membrane was very thick and fibrous. But even in these cases there was no constriction or angulation of the colon or cæcum, and the upper and lower borders were the same as those in the first group. These two cases are of interest in showing that under certain conditions the pericolic membrane may only resemble the

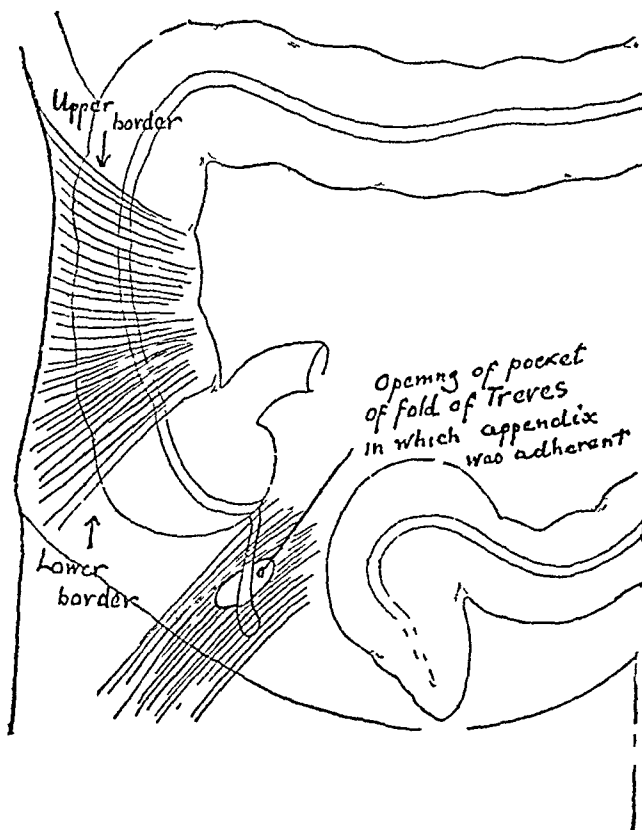


FIG 7—Sam C, aged twenty-eight. Chronic appendicitis. Well marked pericolic fold extending down and inward from hepatic flexure at its upper border to just above cæcum and across to anterior longitudinal band. Appendix lies in pocket formed by fold of Treves.

normal structure in its anatomical distribution, but be many times thicker and quite opaque. One can readily see how such a membrane can undergo either circumscribed or diffuse cicatricial changes with subsequent kinking and other forms of obstruction in the caliber of the colon.

In two other cases of this second group, the upper border of the parietocolic fold was the same as in the first or "normal" group, but at its lower end it covered a portion of or the entire cæcum. In one case (Fig 4) the membrane caused a distinct kinking of the appendix.

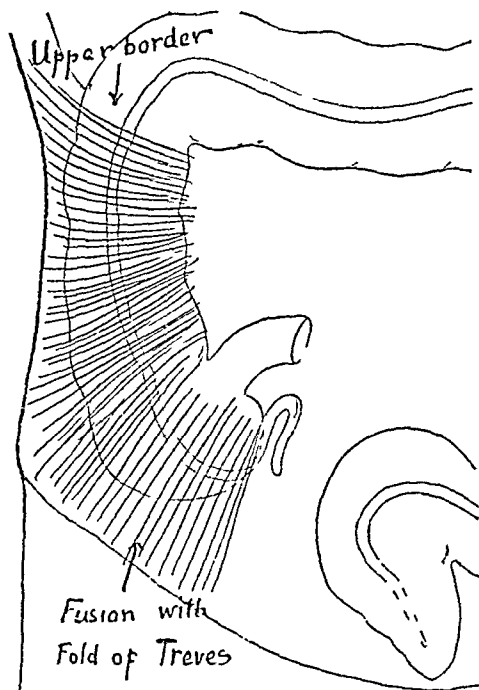


FIG 8—Pearl M, aged twenty-five. Pericolic fold—upper border indistinct becoming thinner and more veil-like toward cæcum where it blends with fold of Treves which covers end of cæcum and appendix. Pericolic fold quite vascular and contains much fat.

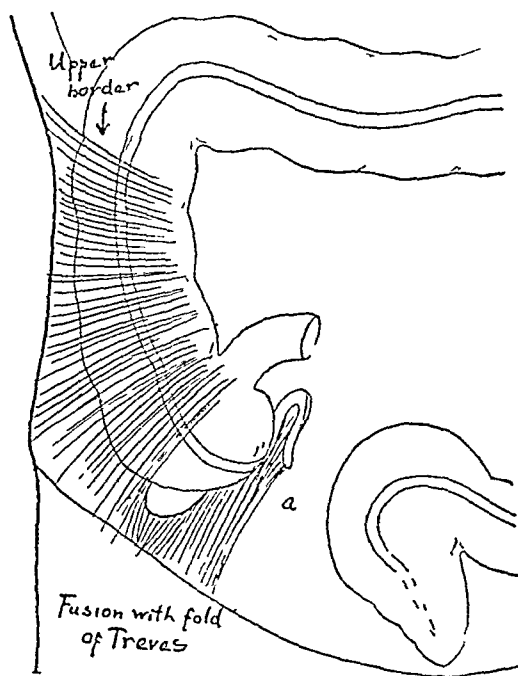


FIG 9—Benjamin E, aged twelve. Acute catarrhal appendicitis. Cæcum slightly movable. Distinct pericolic veil or membrane continuous with parietal peritoneum on outer side and extending inward to mesocolon on inner side of ascending colon. Membrane fuses below with fold of Treves covering entire cæcum and ascending colon. Fold of Treves becomes continuous with meso-appendix at *a*.



FIG. 10.—Photograph (not retouched) of cecocolic region of female adult cadaver—died of cancer of stomach without metastases. 1 reflection on parietal peritoneum of fold of Tonniesco (Jackson vein or per cecic membrane), 2 upper limit of fold or membrane, 3 lower limit of fold or membrane (1½ inches above end of cecum), 4 inner limit of fold or membrane (fuses with mesentery on inner side of ascending colon)



FIG. 11.—Wash drawing of specimen taken from cadaver of man. Cancer of stomach without metastases. 1 wound of lung. UB upper border of parietocolic fold. LB lower border of parietocolic fold. 2 fusion of upper border of parietocolic fold with omentum

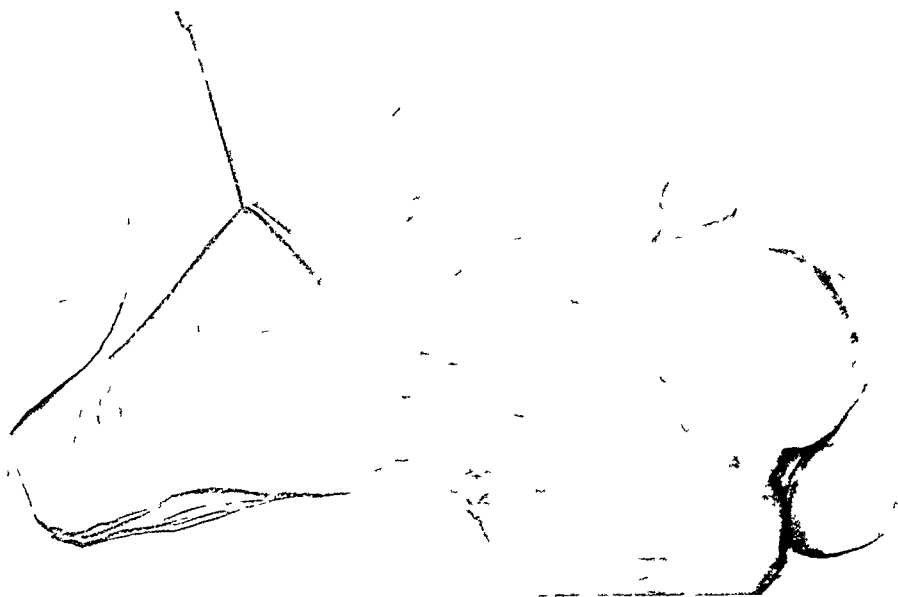


FIG 12 —Lower end of parietocolic membrane shown in Fig 11—lifted up to show reflection from abdominal wall

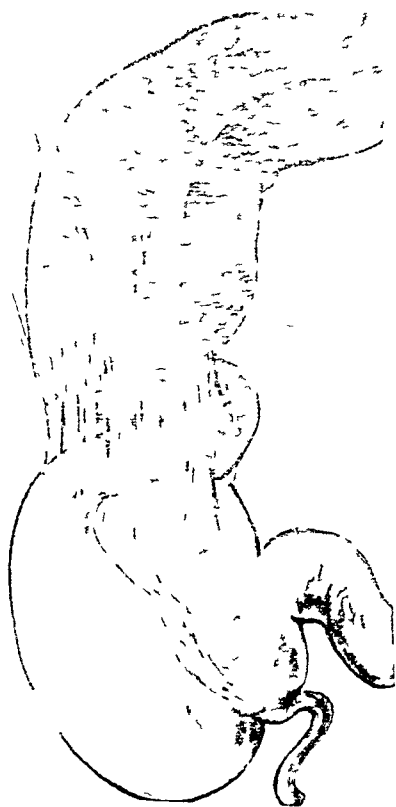


FIG 13 —Parietocolic membrane causing double-barrelled shot-gun deformity of ascending colon



FIG 14 —Left-sided fetal parietocolic membrane U upper and L lower borders

THE SIGNIFICANCE OF THE JACKSON VEIL

with resultant dilatation of the lumen and other changes distal to the kink

Group 3—There were 6 cases in this group, all operated on account of symptoms of acute or chronic appendicitis. In the first three cases (Figs 5, 6 and 7) the parietocolic fold (pericolic membrane, or Jackson veil) and the bloodless fold of Treves were so well developed that one could distinctly note where the pericolic membrane (parietocolic fold, Jackson veil, or fold of Jonnesco) ended and the fold of Treves began, the two being separated by a free space varying greatly in

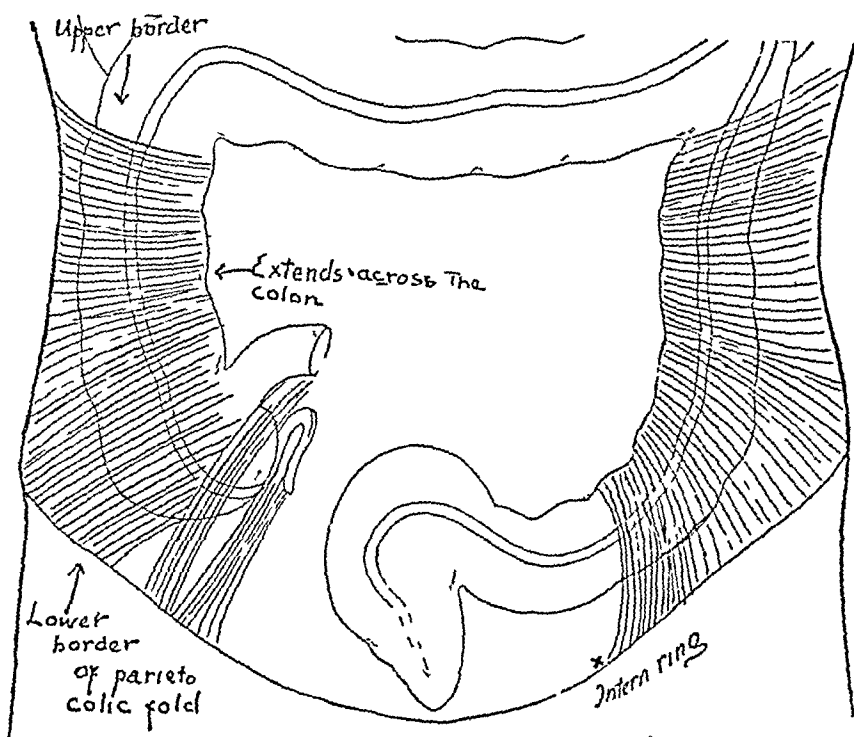


FIG 15 —Fusion of folds of Jonnesco (parietocolic), fold of Treves and of Reid (genitomesenteric) on right side and fusion of left parietocolic fold and genitomesenteric fold of Reid on left side (from six months' foetus)

width. The parietocolic fold had all of the characteristics of the cases regarded as "normal" and placed in Group 1. The bloodless fold of Treves covered the lowermost end of the cæcum or this and the appendix. In the case shown in Fig 7 the appendix was quite firmly ensconced in a shirtwaist pocket-like niche formed by the fold of Treves. Before Eastman² called our attention to this action of the fold of Treves, I had regarded such appendices as lying in a pocket of adhesions. In the cases shown in Figs 8 and 9 the lower border of the parietocolic fold could be seen to fuse imperceptibly with the bloodless fold of Treves, the two covering the cæcum or appendix, or both

² Surgery, Gynecology and Obstetrics, April, 1913

The fold of Treves in one of these cases fused distinctly with the mesentery of the appendix. As in Groups 1 and 2, one could not find any evidences of a kink or other interference with the lumen of the colon or cæcum.

Group 4—In this case the patient was operated on for chronic appendicitis in 1908, a note at that time being made that "the ascending colon showed a well-marked Jackson veil." She returned three years later with symptoms of interference with the movements of the colon, so well described by Jackson in both of his papers. A second operation showed that, as a result of a cicatricial contraction of

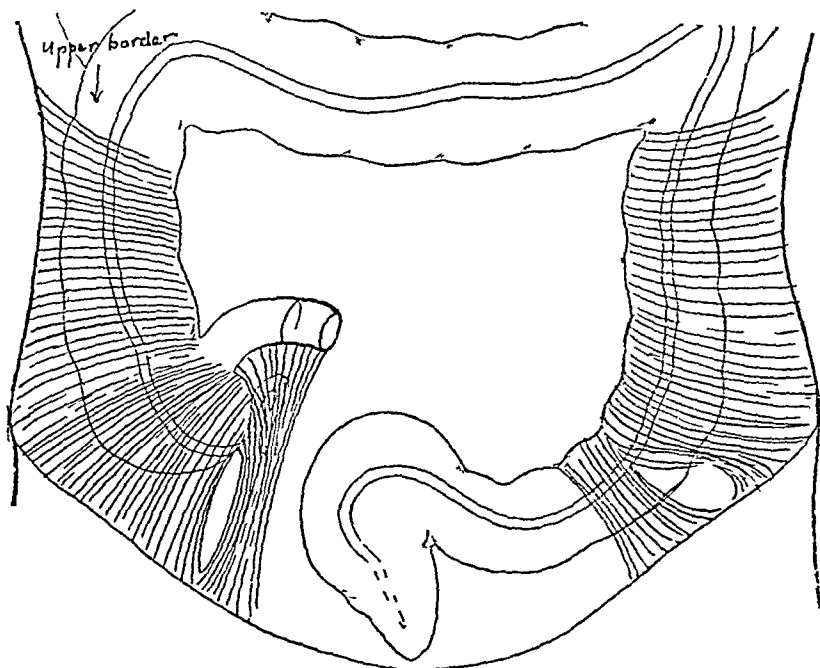


FIG 16—Fusion of parietocolic fold, fold of Treves and genitomesenteric fold of Reid on right side and fusion of parietocolic fold on left side with genitomesenteric fold of Reid. This latter fusion is the rule in female foetus.

a portion of the veil formerly covering the ascending colon, a "double-barrelled shot-gun" deformity had resulted. The cæcum was greatly dilated on the proximal side of the contracted area (Fig 13). An anastomosis of the transverse colon and cæcum was done. I shall refer later to the significance of this personal clinical experience as showing that in some cases the veil may undergo pathologic changes, and cause kinking and other forms of acute and chronic intestinal obstruction.

B. CADAVER OBSERVATIONS

In several recent autopsies the pericolic membrane was studied within a few hours after death, and the results are shown in Figs 10, 11 and 12.

THE SIGNIFICANCE OF THE JACKSON VEIL

The objection may be raised that not a sufficient number of subjects have been dissected. There is no doubt in my mind but that this method would be a most fertile field for a future investigation, but my own few findings corroborated those observed during operations in such a manner that I thought them to be of sufficient value to add as confirmatory evidence.

In Fig 10 is shown the abdominal wall adjacent to the cæcum and ascending colon removed intact and photographed, without retouching the photograph. The specimen shows distinctly a reflection of a fold from the parietal peritoneum to the ascending colon, quite independent

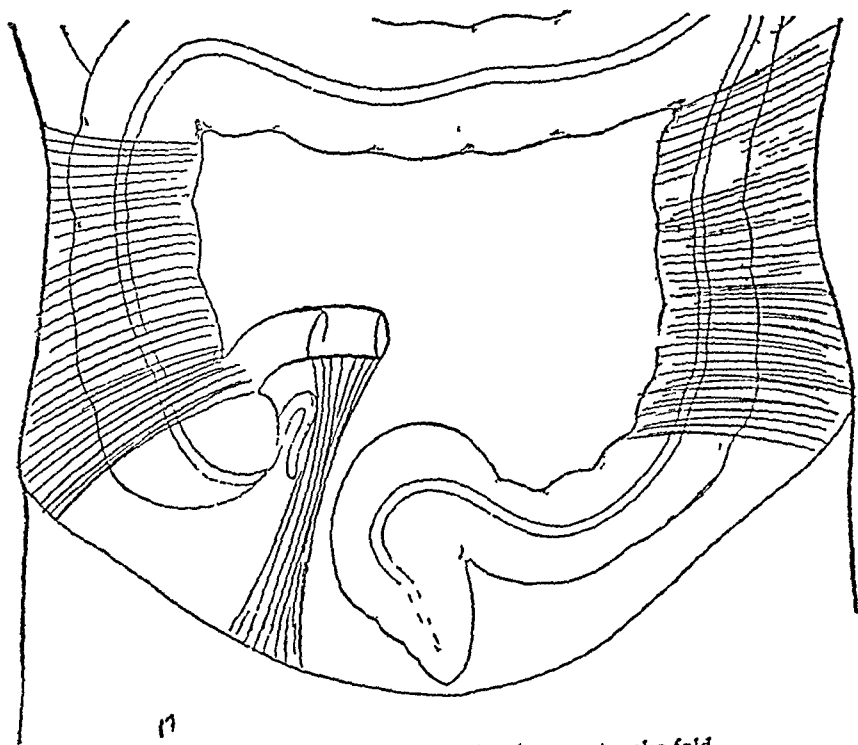


FIG 17 —Well marked left and right parietocolic fold

of the peritoneum lining the abdominal wall on the outer side of the ascending colon. The upper border of this parietocolic fold (fold of Jonnesco, pericolic membrane, or Jackson veil) is at the level of the upper third of the ascending colon, and the lower border about one and a half inches above the end of the cæcum. There is a distinct pocket between this membrane or fold and the peritoneum of the lateral abdominal wall. The membrane contains quite a little fat, and extends across the colon to fuse with the mesocolon on the inner side of the ascending colon. Its fibres are directed downward and inward. The ileocolic region, illustrated in Figs 11 and 12, was not adapted for a

photograph, but was most conscientiously drawn from the fresh specimen to show the pericolic membrane. The membrane was much thinner than in the specimen shown in Fig 10, and contained a number of fine vessels.

Its distribution as well as its upper and lower borders corresponded accurately to the description given by Hall of Jackson's first case. It extended from the hepatic flexure to a point about one and a half inches above the cæcum, and fused on the inner side of the upper part of the ascending colon with the right end of the omentum (Fig 11, O).

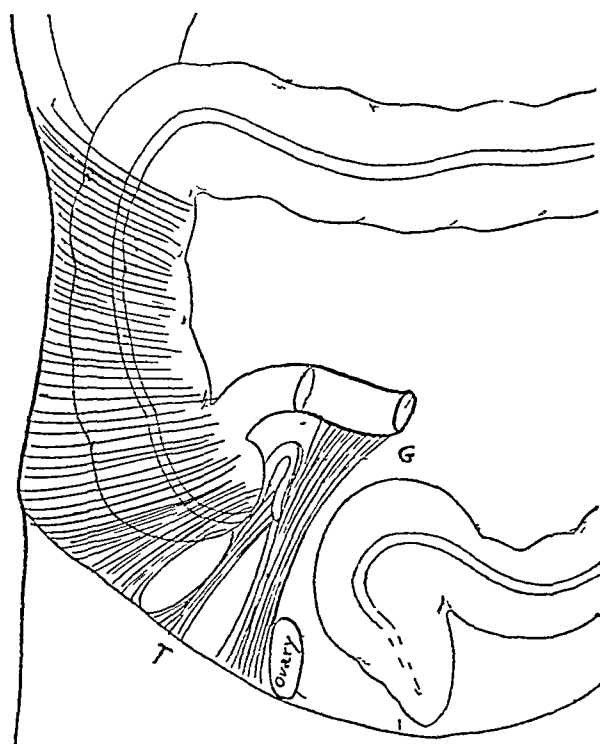


FIG 18 —Fusion of fold of Treves and parietocolic fold

In Fig 12 the artist has attempted to show how the membrane can be lifted from the parietal peritoneum of the posterior abdominal wall.

In one of these cadavers the cause of death was a carcinoma of the stomach without peritoneal metastases. In the other, the cause of death was a stab wound of the lung. Both specimens show different stages of the pericolic membrane. In one (Fig 10) it is firm, but not fibrous, and contains much fat. In the other it is extremely thin and translucent. In both, the ascending colon and cæcum were normal in caliber and appearance.

THE SIGNIFICANCE OF THE JACKSON VEIL

C EXAMINATION OF FŒTUS

We have examined and made notes of our findings in 10 cases (see Figs 14-20, inclusive) The ages varied from 6 months to full term The results were far more uniform than those reported by Dr. Eastman who found the parietocolic fold in 5 of 28 fetuses We have found it in nearly every dissection of cases where the rotation of the cæcum was complete It had the same limits as in post-uterine life, but the membrane itself was extremely thin and contained a number of fine capillaries, which were directed downward and inward In some of the dissections there was a fusion of the parietocolic fold on the right

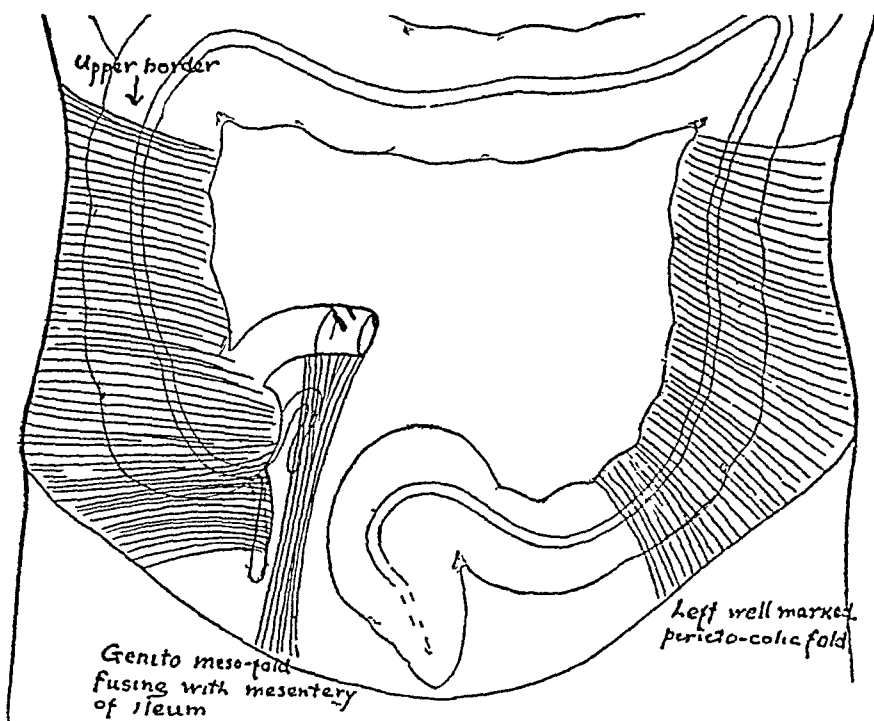


FIG 19 —Poorly developed parietocolic fold on right side with undeveloped fold of Treves The genitomesenteric fold on right side fused with mesentery of ileum Well marked left sided parietocolic fold with upper border at splenic flexure and lower border at junction of sigmoid and descending colon

side with the fold of Treves and the genitomesenteric fold of Reid The latter was quite constant on both sides, especially in female cadavers In several specimens the parietocolic fold fused with the fold of Treves at only one point, the remainder showing a pocket-like gap, in which the appendix lay One foetus showed imperfect cæcal rotation, with an absence of both the parietocolic fold and the bloodless fold of Treves The genitomesenteric fold was well developed, however.

Fig 20 was sketched from a foetus where a localized thickening of the right parietocolic fold caused a distinct kink of the ascending colon

The suggestion offered by Eastman that a thickened and cicatricial genitomesenteric fold corresponds to the ileopelvic band of Lane, causing kinking of the ileum, seems to us a very plausible one

One of the most interesting facts which our examination of fetal cadavers revealed was the constant presence of a parietocolic fold on the left side, corresponding in every particular to the same structure on the right side Fig 13 shows such a membrane drawn from a full-term foetus In some of the specimens (six in number) the upper border was at the level of the splenic flexure, and fused imperceptibly with the left end of the omentum The lower border of this left pericolic membrane was at the junction of the descending colon and

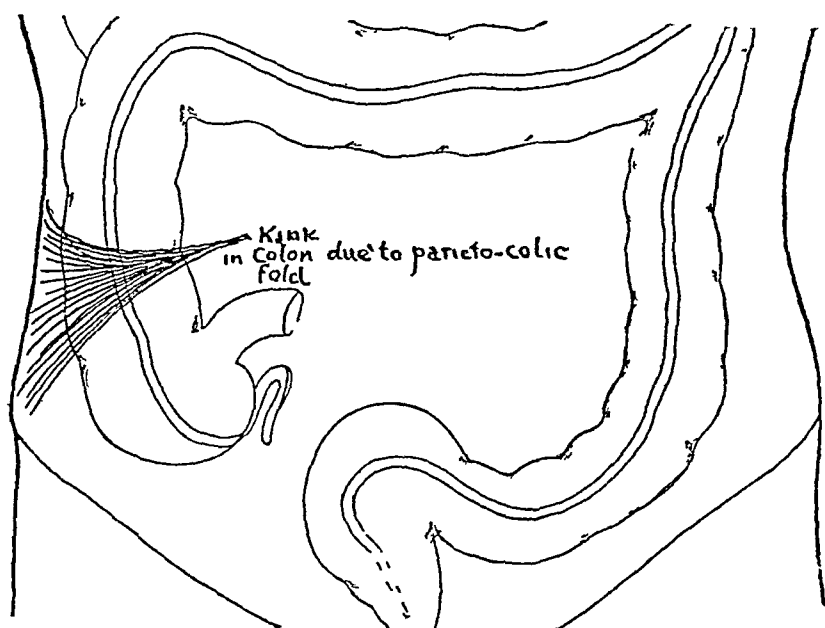


FIG 20 —Parietocolic fold producing a distinct kink in ascending colon

sigmoid (Fig 19) In several specimens there was a fusion of the left parietocolic fold with the genitomesenteric fold of Reid The point of reflection of the left pericolic membrane from the parietal peritoneum was the same as on the right side, and it passes across the descending colon to unite with the mesocolon. Dr John E Summers had called my attention to similar observations made by Gray and Anderson in 1912 and published in the form of a monograph

SUMMARY

From our observations during operation, from dissection of cadavers, and, finally, from examination of 10 foetuses, we believe that certain conclusions can be drawn

THE SIGNIFICANCE OF THE JACKSON VEIL

The parietocolic fold of Jonnesco, synonymous with the pericolic membrane or Jackson veil, is a reduplication or fold of peritoneum, which is constantly found during fetal and postnatal life. This membrane corresponds in every way to the description given by Hall of Jackson's specimens in his two principal papers, published in 1908 and 1913, respectively. It is a fine translucent membrane, which varies greatly in vascularity. In some of our cases there were only a few fine capillaries, while in others the membrane was extremely vascular. The upper border of this right-sided pericolic membrane is almost invariably at the level of the hepatic flexure, and its lower border from one to one and one-half inches above the lower end of the cæcum. In some of our cases the lower border either extended a little further down and covered the entire cæcum and a portion of the appendix, or fused with the fold of Treves. In the great majority of cases this fusion did not occur. The vessels of the pericolic membrane are, as a rule, directed downward and inward. In two of our cases (see Group 2) the membrane was as thick as ordinary card-board, and showed practically no vessels. In the remainder of the patients the membrane was very thin. It extends inward across the front of colon to the attachment of the mesocolon, and either fuses with the peritoneum covering the latter or fuses with the omentum along the upper third of ascending colon. These may be called normal cases, the membrane being a persistence of a fetal structure, and under no circumstances should it be stripped off. Such a step would result in leaving an extensive denuded surface.

From the examination of our specimens and from observation in the living, we believe that the genitomesenteric fold of Reid is the forerunner of the ileopelvic band of Lane, and bears the same potential relation to the Lane kink that the pericolic membrane bears to possible kinks of the ascending colon. That such constrictions occur one can no longer doubt. The case reported in Group 4 affords ample proof of the rôle which the Jackson veil may play in the production of acute and chronic obstruction of the ascending colon and cæcum. We are not prepared to state at the present time what causes this change in the pericolic membrane from an innocent persistent fetal structure to the production of a distinct pathological entity. In our opinion Jackson, Pilcher, Gerster, Flint, and others have rendered a great service in calling attention to the various sequelæ of such pathological changes in the pericolic membrane.

One of the chief objects of this investigation, we believe, has been fulfilled by calling attention to the fact that there are two distinct

types of pericolic membrane (1) those which are innocent, and (2) those which may cause mechanical interference with the function of the colon. Each case must be judged upon the operative findings and one is not justified in saying that every pericolic membrane requires interference. The majority are perfectly normal structures.

Our examinations of fetal cadavers confirm those of Gray and Anderson, that there is a left parietocolic fold, which corresponds in every detail to the same structure on the right side. It is a constant finding in the foetus, and no doubt search for it in the future during operations on the left side of the abdomen will confirm these fetal observations.

The treatment of the pathological conditions due to the right pericolic membrane must depend on the findings in the individual case.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY

*Stated Meeting, held at the New York Academy of Medicine,
April 8, 1914*

The President, DR. FREDERIC KAMMERER, in the Chair

ILEOSIGMOIDOSTOMY APPENDECTOMY VISCEROPTOSIS WITH ADHESIONS

DR. PARKER SYMS presented a woman, twenty-nine years old, who was admitted to the Lebanon Hospital on January 11, 1914. Her family history was negative. The patient gave a history of a curettage three years ago, and stated that during the past seven years she had had repeated attacks of pain in the right iliac fossa, these attacks were of a few days' duration and were accompanied by vomiting.

Present history About three weeks before her admission the patient had an attack of influenza, which lasted one week. A week later, while still in bed, she was seized with pains over the abdomen, with fever. She vomited three times, her bowels were constipated.

At the time of her admission, the patient showed evidences of acute intestinal obstruction. There was marked distention of the abdomen, and she felt nauseated. The pulse and temperature were normal, as was also the blood count. An examination of the urine was negative. The bowels were relieved by repeated enemata. The clinical picture was that of an acute mechanical obstruction of the bowels.

Operation Upon opening the abdomen through a free rectus incision, the appendix was found to be in a condition of chronic inflammation, and bound down by a contracted mesentery. The colon was much displaced and distorted, and the abdomen was filled with adhesions. As the patient's condition was unsatisfactory, Dr. Syms decided not to prolong the operation by separating adhesions, straightening out kinks, etc., and proceeded at once to transplant the lower end of the ileum into the sigmoid, doing a lateral anastomosis, with clamps.

The patient made a satisfactory recovery from this operation, and began to improve in every way. She had gained considerably in weight and now enjoyed excellent health, whereas prior to the operation she had been a hopeless neurasthenic. She was entirely free from bowel

disturbance, and was able to attend to her household duties with comfort While the final outcome of the case was still in doubt, the present outlook was very encouraging

DR ROBERT T MORRIS said that in the case reported by Dr Syms the operative procedure might perhaps have been simplified somewhat by lifting up the ileum and, without stopping to break the adhesions, placing it against the visible part of the sigmoid and doing an anastomosis, making the incision at least two and a half inches long By this method, the speaker thought, there was less danger of reversed peristaltic action by which the contents of the gut would be carried back into the colon In one case where he short-circuited the bowel, the patient, a chronic asthmatic, was not only relieved of her intestinal symptoms, but had also remained free from her former violent attacks of asthma

PERINEAL PROSTATECTOMY BY A SPECIAL METHOD

DR SYMS presented a man, sixty-seven years old, who was admitted to the Lebanon Hospital December 14, 1913, with symptoms typical of prostatic obstruction These dated back four or five years, when he began to have frequency, voiding urine every hour About a year and a half ago he began to suffer from pain in the lumbar region, with increased frequency Ten days before his admission to the hospital he developed complete retention of urine, and since then he had to be catheterized Otherwise, physically, he was in good condition, and his urine was normal, excepting for the presence of pus and bacteria in a moderately heavy sediment

Dr. Syms said his reason for showing this patient was to illustrate a method of prostatectomy which he proposed in a paper read before this Society in November, 1898 The method consisted in making a small, suprapubic incision which extended down to, but did not enter, the bladder The patient was then placed in the lithotomy position and a median perineal incision was made, exposing the prostate The sheath was opened and the prostate enucleated through the perineum Through the suprapubic incision the operator or his assistant could exert pressure, pushing the prostate downward This rendered enucleation easy, and made it possible to reach the prostate without the aid of tractors of any kind Using the fingers of the two hands, one above and one below, the operator could enucleate the prostate with great precision and facility The bladder not being opened above or below, this operation had all the advantages of the perineal method, and was devoid of the great disadvantages of the suprapubic method

DOUBLE PERINEPHRITIS

In this particular case the patient made a rapid and satisfactory recovery, and now had perfect bladder function, that is, he was able to empty his bladder and had entire control over it. Recently, Dr. W. H. Stewart took a radiograph of his bladder while distended with a solution of collargol, and the picture showed that the internal sphincter had been perfectly preserved. At the present time there was slight irritability of the bladder, which would doubtless soon disappear.

DOUBLE PERINEPHRITIS WITH SEVERE RENAL COLIC AND LEFT HYDRONEPHROSIS

DR SYMS presented a man, twenty-three years old, who was admitted to the Lebanon Hospital on December 12, 1913, with the history of scarlet fever in childhood and removal of the appendix six months ago. He was moderately addicted to the use of alcohol and tobacco, denied a venereal history.

Present history. Two years before admission, he was seized with intense pain in the left lumbar region, radiating downward anteriorly into the penis and accompanied by chills and vomiting. This attack lasted about two days. During the attack he was able to pass urine in small quantities, and he had never noticed any blood. A year ago he had a second, similar attack on the right side, lasting about 48 hours. Two days before admission he had another attack similar to the first.

Physical examination was negative, with the exception of tenderness over the left kidney region. Cystoscopic examination and ureteral catheterization by Dr. Abraham Hyman showed some congestion of the bladder, especially in the region of the trigone. The right ureteral orifice appeared normal, the left was somewhat oedematous. A catheter was introduced into the right ureter without obstruction, and some bloody urine obtained. Dr. Hyman thought the blood might be due to traumatism. On the left side, as soon as the catheter entered the pelvis, there was a profuse flow of dark, turbid urine, containing blood clots, showing that there was an obstruction in the ureter, with consequent hydronephrosis. An injection of indigo carmine was secreted by the right kidney in twenty minutes, and by the left kidney in eleven minutes. Examination of the urine from each kidney separately showed the presence of red blood-cells, albumin, with granular and hyaline casts. An X-ray did not show the presence of stone.

The conditions in this case, Dr. Syms said, were unique in his experience. For two years or longer this patient had suffered at various times from severe attacks of renal colic. He had visited several hospitals in this city, where he had been examined for stone, and none being

found, he had not been subjected to operation. In the intervals between the attacks the patient had not been entirely well, suffering more or less pain. When he came to the Lebanon Hospital, he was suffering agonies from a severe attack of left renal colic. When the cystoscopic examination was made, and the left kidney was emptied, he experienced immediate relief, but a few hours later he had a severe attack of renal colic on the right side which persisted up to the time of his operation. The operation consisted in decapsulation of both kidneys. The left ureter (the side of the hydronephrosis) was kinked and compressed by an aberrant vein which was surrounded by dense fibrous adhesions extending from the kidney capsule. Both capsules were much thickened and presented the appearance of a peculiar fibrous tissue. As it was stripped off, it left a bleeding surface. The capsule had doubtless contracted, for the kidneys bulged as the enveloping membrane was partially removed.

Since the operation, the patient has felt complete relief for the first time in two years, and he is now enjoying perfect health and comfort.

APPENDECTOMY RESECTION OF PERFORATED ILEUM LATERAL ANASTOMOSIS

DR SYMS presented a man, forty-two years old, a printer, who was admitted to the Lebanon Hospital on January 4, 1914. His family history was negative, with the exception of the fact that his father died of tuberculosis. The patient had typhoid fever five years ago.

Present illness. Four days before his admission to the hospital the patient had an attack of abdominal pain, with fever, and was confined to bed. His pain, which was generalized, steadily grew worse, and he was sent to the hospital. His bowels were markedly constipated. He stated that about six months ago he had suffered from a similar attack. At that time the pain was localized in the epigastric region and lasted a few days. There was no vomiting. He also gave a history of several similar but milder attacks during the past few years.

On admission, there was tenderness over the abdomen, with marked rigidity on both sides. His temperature was 103° , but soon fell to normal. His pulse was 80. A blood count showed 12,000 white cells, with 77 per cent of polynuclears, lymphocytes, 21 per cent, mononuclears, 2 per cent. The stomach contents showed hyperacidity.

When Dr Syms first saw the patient, his condition suggested a partial mechanical obstruction of the bowels rather than an acute appendicitis or peritonitis. His abdomen was tympanitic, and so distended that it was impossible to make a satisfactory examination. He was kept

INTUSSUSCEPTION OF THE APPENDIX

under careful observation, and the bowels were slowly relieved by repeated enemata. When the distention had subsided, one could make out a tender, movable mass, which was apparently the appendix, adherent to the cæcum.

Operation. As the case was one requiring exploration, Dr. Syms made a free right rectus incision, encountering numerous adhesions which showed evidence of both recent and chronic inflammation. The appendix, which was bound down toward the pelvis, was deeply imbedded in adhesions. These were very dense, binding the cæcum down in an abnormally low position, enough to cause constipation. The omentum was also involved in these adhesions. The adhesions were divided, the cæcum liberated, and the appendix removed with ligature and cautery.

The most interesting feature of this case, Dr. Syms said, was the fact that near the terminal end of the ileum he found an inflammatory mass consisting of two adherent coils of small intestine which were wrapped up in omentum and intimately joined together by organized adhesions. Stripping off and resecting the omentum disclosed what appeared like a spontaneously formed anastomosis between these two coils of intestine, situated about three inches from the terminal end of the ileum. There was pus in the mesentery of the lower coil. This portion of the ileum was resected, together with its mesentery, the ends of the bowel were closed, and the continuity re-established by making a side-to-side anastomosis.

Upon opening the specimen of resected intestine, it was found that there was a small, round perforation into the intestine, with no apparent ulceration. The pathogenesis of this lesion could not be surmised—was it an abscess caused by a perforation of the bowel, or was it a perforation caused by an absence of the mesentery opening into the bowel?

The patient made a satisfactory recovery, and to-day, ten weeks after the operation, he was in better health than he had been for years.

INTUSSUSCEPTION OF THE APPENDIX

DR. A. V. MOSHCOWITZ presented a boy, ten years old, who was admitted to the Mt. Sinai Hospital on December 4, 1913, with the history that for years he had suffered from cramp-like pains in the abdomen. These were paroxysmal in character, persisting a few hours, and during the intervals he felt perfectly well.

Two days prior to his admission he was seized with this cramp-like pain in the abdomen. This attack, however, unlike the previous ones, persisted, and soon became localized in the right iliac fossa.

Upon examination, there was found a small, hard and but very slightly movable mass in the right iliac fossa, which was extremely painful and tender. The case was regarded as one of acute appendicitis, and an immediate operation was done. At first, no appendix was found, but further search revealed about one centimetre of the appendix protruding from the cæcum. The condition was recognized as an intussusception of the appendix, which was finally disinvaginated with some difficulty and removed in the usual manner. The boy's recovery was uneventful. The appendix was about three inches long, and showed a necrosis of the mucosa and œdema of all its coats.

In an article published in the *N. Y. Medical Record*, December 17, 1910, Dr. Moschcowitz said he collected all the cases of intussusception of the appendix then on record, numbering 24, to which he then had added one case of his own. Unless other cases had been published in the meantime, the case shown to-night would be the twenty-sixth. In the article referred to, he had entered at some detail into the pathology of the condition, and described the three varieties or degrees that had been observed. The case shown to-night belonged to that variety in which the intussusception began at the junction of the appendix and cæcum. more and more of the appendix became inverted, until the process was checked by swelling of the coats or by adhesions between the apposed serous surfaces.

DR FRANK S. MATHEWS recalled a case of intussusception of the appendix in a child of five years, where about an inch of the appendix protruded and a mass could be felt within the cæcum. The area of the gut surrounding this mass was œdematous. The history, which dated back ten days, was that the child had suffered frequent attacks of colic, with slight temperature elevation. There was no tenderness nor rigidity, but upon physical examination a very definite lump could be made out in the appendicular region.

DR HOWARD LILIENTHAL said the late Dr. Edebohls, about seventeen years ago, suggested that such an invagination of the appendix should be deliberately produced instead of doing an appendectomy, and that Dr. Edebohls carried out that method in a number of cases.

DR ROBERT T. MORRIS said one reason Dr. Edebohls' method did not become popular was that the appendix often sloughed.

DR MATHEWS said that in cases of ordinary intussusception of the bowel in children, the base of the appendix sometimes formed the apex of the intussuscepted gut.

DR MOSCHCOWITZ, in closing, said he was also of the opinion that the three varieties of intussusception of the appendix that he had

PROLAPSE OF THE RECTUM

described simply represented the same condition in different stages of its development, and that the case he had shown to-night was an example of an intermediate stage. In this connection, he recalled a case reported by Dr. George E. Brewer of this city, where the patient had been twice operated on for supposed appendicitis, and where no appendix could be found. At a third operation, Dr. Brewer found one of these cases of intussusception, with the appendix concealed within the gut.

PROLAPSE OF THE RECTUM MOSCHCOWITZ OPERATION

DR. JAMES I. RUSSELL presented a Russian carpenter, aged twenty-nine, who was admitted to Dr. Brewer's service at the Roosevelt Hospital on October 27, 1913, with the history that for the preceding eighteen months he had suffered from a prolapse of the rectum which had increased rapidly in size during the last two months. The condition had not interfered with his work, and while it had caused him considerable discomfort, there was no real pain. He was able to protrude the rectum at will, and the mass had always been reducible.

Upon examination, the protruded rectum measured two and a half inches in length upon the anterior surface, and about three and a half inches upon the posterior surface. The mucous surface was somewhat congested, but not eroded.

Three days after admission, under ether anæsthesia, the Moschcowitz operation was done. The abdominal wound healed kindly, and the patient left the hospital on November 28, 1913, four weeks after the operation. At that time there was a very slight rolling out of the anal mucous membrane upon straining. Five months had now elapsed since the operation, and inspection at the present time showed that the rectum still prolapsed about $\frac{1}{2}$ inch when the patient forced it down.

DR. JOHN A. HARTWELL said that Dr. J. P. Hoguet, assisted by himself, had performed this operation on a child about eight months ago. The patient was a poorly nourished Italian infant, with an osteomyelitis of the tibia, and after various conservative methods for reducing the prolapse of the rectum had been unsuccessfully tried, this operation was done, with very satisfactory results, and, up to the present time, there were no signs of a recurrence. The condition found at operation showed the prolapse to be of the whole rectal wall, that is, a true hernia and not simply a prolapse of the mucosa.

DR. LILIENTHAL said he had watched the development of this operation in the hands of Dr. Moschcowitz, and he had no hesitation in stating that in adults, at any rate, the method was a very sensible one.

and the results were very satisfactory. In children with prolapse of the rectum he thought that an operation was seldom, if ever, necessary. In young patients, by the strapping method, holding the buttocks firmly together, he had thus far never failed to effect a cure.

DR WILLIAM C LUSK, speaking of the possibility of treating some cases of rectal prolapse successfully without operation, said that he had once seen a complete rectal prolapse protruding about 3 inches through relaxed sphincters, in an insane patient who was luetic and greatly emaciated. The patient was too weak to operate upon and was put upon mixed treatment and a nourishing diet. He soon put on weight and when next observed, 4 or 5 months later, had become quite stout, the buttocks had become rounded, the ischiorectal fossæ had filled out with fat and the prolapsed bowel had gone back into place and remained there.

DR KAMMERER said he was inclined to agree with Dr. Lilienthal that in children suffering from this condition, an operation was rarely necessary. At least, none should be advised until other methods had failed, especially if we succeeded in removing other predisposing factors.

The speaker said that, about a year ago, when Dr. Moschcowitz presented some excellent results obtained by this operation, he (Dr. Kammerer) mentioned a case of his own where he had done several other operations in a very aggravated case of prolapse, and these failing, he had finally resorted to the method under consideration. In this case, after six months, however, there was a recurrence of the prolapse.

DR HARTWELL said he also agreed with Dr. Lilienthal that it was usually unnecessary to operate for this condition in children. At Bellevue Hospital they had a large number of these cases in young patients, and they usually got well without an operation. The case he mentioned, however, was an exception, in which all the conservative measures had failed.

DR MOSCHCOWITZ was of the opinion that the case shown by Dr. Russell was by no means cured. All the cases operated by this method—which went by his name—were not cured, and perhaps the main point in its value lay in the fact that it was a step in the right direction in explaining the pathogenesis of prolapse of the rectum. This form of prolapse was really a hernia, and by this method we obliterated the cul-de-sac of Douglas. The speaker said that not all of his cases had been cured by this method. In most of them the patients themselves were well pleased by the result, but not always the surgeon.

ACUTE ILEUS FOLLOWING GASTRO-ENTEROSTOMY

In children, what was often regarded as a prolapse of the rectum was simply a prolapse of the mucous membrane of the anus. The latter could be cured by almost any method, but a true prolapse of the rectum almost invariably required an operation.

ACUTE ILEUS FOLLOWING GASTRO-ENTEROSTOMY FOR DUODENAL ULCER

DR. RUSSELL presented a man, twenty-nine years old, who was admitted to Dr. Brewer's service at the Roosevelt Hospital on March 30, 1913, complaining of pain in the right upper quadrant of the abdomen. His history dated back twelve years, when he began to have griping pains, intermittent in character, in the right, upper quadrant, coming on ten or fifteen minutes after the ingestion of food and lasting from one to three hours. There was no history of vomiting excepting when it was self-induced for the relief of pain. For ten years, until two years ago, he would enjoy intervals of from one to three months, when he would be entirely free from symptoms. During the past two years the pain had increased in severity. There was no history of blood in the vomitus or stools. He had lost 20 pounds in weight during the past few years. He was always hungry, but afraid to eat. He denied gonorrhoea and syphilis, and there was no record of any other illness. For the past five years he had taken no alcohol.

At the time of his admission to the hospital the patient was poorly nourished. Physical examination was negative excepting for slight tenderness over the appendix and in the region of the duodenum. The bismuth X-ray plates were suggestive, but not positive for ulcer. A gastric analysis showed free hydrochloric acid, 44.5, total acidity, 72, no blood; no lactic acid. The stools were negative for blood.

Operation, April 2, 1913: After removing the appendix, which showed evidences of chronic inflammation, through an intermuscular incision, Dr. Russell exposed the upper quadrant of the abdomen through a median cut, and found a small ulcer on the anterior surface of the duodenum. A short-loop, posterior gastro-enterostomy was then done by the suture method, not excluding the pylorus. On the first and second days after the operation the patient vomited once, while on the third, fourth and fifth days he vomited several times. On the sixth day he was worse, and his condition becoming serious, the median wound was re-opened under light anæsthesia and the anastomosis inspected. The jejunum was found to be sharply angulated upon itself at the point of the anastomosis, causing a complete obstruction. An entero-enteros-

tomy was done with a Murphy button between the proximal and distal limbs of the jejunum. There was no further vomiting after this operation. Feeding was begun almost immediately on account of his starved condition, and he gained rapidly in health and strength. A year had now elapsed since the last operation. The patient had remained entirely free from his former symptoms, he eats whatever he likes and had gained considerable in weight, 25 pounds.

DR JOHN F ERDMANN said it would be rather interesting to know the number of times that acute gastric dilatation occurred after gastro-enterostomy. In almost every one of his recent cases he had been obliged to resort to lavage of the stomach. In two cases several years ago where he re-opened the abdomen, thinking he had to deal with a vicious loop, he found a condition similar to that described by Dr Russell. Both of those patients had no difficulty whatever with their loop, and after doing an entero-enterostomy the vomiting still persisted. He then put them on semisolid food, with a prompt abatement of the vomiting. In dealing with such cases now it was his practice to wash out the stomach and put them on semisolid food on the fourth or fifth day. He attributed the vomiting in these cases to acute gastric dilatation, and suggested that possibly that condition might have been responsible for the symptoms in the case shown by Dr. Russell.

DR LILIENTHAL thought that perhaps the length of the stoma was responsible for the symptoms in Dr Russell's case. The speaker said that in one of his own cases, after gastro-enterostomy, he had found that the stoma was too long, producing an actual prolapse of the intestinal wall into the stomach and giving rise to a vicious circle.

DR KAMMERER said he did not quite understand how a prolapse into the stomach of the wall of the intestine opposite the gastro-enterostomy opening could ever occlude the latter. This almost seemed to him a mechanical impossibility, as the pressure of the contents of the stomach upon the prolapsed wall would tend to reduce the latter to its normal position.

MUSCULOSPIRAL PARALYSIS FOLLOWING FRACTURE OF THE HUMERUS

DR ARTHUR S VOSBURGH presented a man, fifty-three years old, who, in September, 1912, sustained a fracture of the humerus at the junction of the upper and middle thirds, compounded from without by a small, punctured wound, not over the line of the fracture. The X-ray showed a transverse fracture through the shaft, with but slight dis-

MUSCULOSPIRAL PARALYSIS

placement of the fragments. He was treated by coaptation splints and a plaster cap to the shoulder and arm. After nine days he was discharged from the hospital and directed to report at the clinic for observation.

He was re-admitted to the hospital on December 30, 1912, it having been discovered on removal of the dressings that he had wrist-drop, with anæsthesia over the posterior surface of the forearm and hand. No mention of this condition had been made in his previous history.

Operation: On January 13, 1913, Dr. Vosburgh exposed the musculospiral nerve, which was found firmly bound down in the fibrous tissue about the site of the old fracture, but not involved in the callus. The continuity of the sheath was not destroyed, but the nerve had undergone a compression to the extent of half an inch. No scar tissue could be made out in this section of the sheath, and it was decided not to divide and resuture the nerve.

Restoration of function was now almost complete, with the exception of slight weakness in the muscles. In view of the total paralysis existing at the time of the operation this was encouraging.

The speaker said that Dr. Alfred Taylor had pointed out that where a nerve had been traumatized, the scar tissue that formed in the sheath at the site of the injury often prevented the regeneration of the nerve along its course.

Owing to the rather slow restoration of function in this case, Dr. Vosburgh thought it might have been a better procedure to have divided the nerve and resutured it.

DR. KAMMERER said that some years ago he showed a case where, after a backward dislocation of the elbow which was twice reduced, there was a gradual but complete paralysis with subsequent atrophy of the muscles supplied by the ulnar nerve. After six months, the speaker said, he cut down on this nerve, exposing it for a distance of about six inches, and found nothing abnormal, excepting, perhaps, at one point, where there seemed to be a slight constriction by a band of connective tissue. This was divided and, following this operation, immediate improvement began, which went on to perfect recovery.

Dr. Kammerer thought the question of a lesion of the musculospiral nerve after fracture of the humerus was a very important one. In the case shown by Dr. Vosburgh the outlook for complete restoration of function seemed very favorable. The return of motion was of course slow, and there were cases on record where more than a year had elapsed before any improvement was noticed.

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FRACTURE OF THE ANATOMICAL NECK OF THE HUMERUS ASSOCIATED WITH SUBGLENOID DISLOCATION

DR. BENJAMIN T. TILTON presented an Italian, forty-five years old, who four months prior to his admission to the hospital fell a distance of four feet, striking on the palm of his outstretched left hand. Immediately following this accident he was treated in another city, the injury being regarded as one of fracture of the upper end of the humerus.

Since the accident he had suffered from marked disability of the arm and shoulder, and when Dr. Tilton saw him, three weeks ago, there was œdema of the hand and forearm, and a noticeable flattening of the shoulder. He was unable to place the hand on the opposite shoulder, and all movements were much restricted. In the axilla the rounded surface of the head of the humerus could be felt, which did not move on rotating the arm. The diagnosis of a subglenoid dislocation of the separated head was confirmed by an X-ray picture.

Three weeks ago an operation was done for the purpose of removing the detached head of the humerus. On account of its location, deep in the axilla, an incision was made in this region, exposing the articular surface. This, after considerable difficulty, was freed from the surrounding soft parts, and its detachment from the shaft was accomplished by grasping the head with a lion-jawed forceps and rotating it. One of the tendons attached to the greater tuberosity resisted traction and had to be divided with scissors after an anterior incision between the deltoid and the pectoralis major muscles. The hemorrhage was not serious and both wounds healed without incident.

The patient had already begun to show marked improvement in the function of the arm. The œdema due to pressure of the head upon the veins in the axilla had almost entirely disappeared, and there was no more pain. The fragment removed showed a clean fracture through the anatomical neck.

DR. LILIENTHAL said that a few years ago he had an unfortunate experience with a case of fracture through the anatomical neck of the humerus, with dislocation, in which the lesion was almost exactly like the one in the case presented by Dr. Tilton. The loosened head of the bone had become displaced down to the edge of the pectoralis muscle, far away from its normal position, and the case was of particular interest because it eventually led to a lawsuit. The patient was a man who had sustained an accident in Omaha, where a physician told him he had sustained a dislocation of the shoulder, which he proceeded to

CICATRICIAL STENOSIS OF THE PYLORUS

reduce by placing his booted foot in the axilla, and then applied a Velpeau bandage.

When the patient subsequently consulted Dr. Lilienthal, the latter refused to examine him until an X-ray was taken, which showed the true condition, and the patient was then told that the head of the bone should be removed. To accomplish this an incision was made along the border of the pectoralis and the loose head of the bone was removed. On the following day the patient was unable to use the hand, and he subsequently brought suit against Dr. Lilienthal for \$50,000, claiming that in the course of the operation, while attempting to secure a bleeding vessel, he had crushed and injured a nerve irreparably. When the case came to trial, two years later, the functions of the arm had been restored, and the man was entirely well. Dr. Lilienthal stated that he believed no plastic operation could have produced such a perfect result.

CICATRICIAL STENOSIS OF THE PYLORUS POSTERIOR GASTRO-ENTEROSTOMY

DR. TILTON presented a man of forty, a laborer, who had suffered for fifteen years from gastric disturbance, consisting chiefly of epigastric distress, pyrosis and vomiting. The pain usually came on from half an hour to two hours after eating. During the past year the symptoms had become more or less constant and more severe, and he had been unable to retain any solid food in the stomach, with consequent loss in weight and strength. The vomited material was considerable in amount and had a peculiar foul odor. The microscopic examination of the vomitus showed starch, fat, muscle fibre, vegetable cells and sarcinae ventriculi. Chemical analysis showed a total acidity of 90, free hydrochloric acid 54, and impaired starch digestion. The motility tests showed a marked impairment and considerable stasis.

A diagnosis of pyloric obstruction of a benign character was made and operation revealed a marked thickening in the pyloric region with dense adhesions. The stomach was greatly dilated. A posterior no-loop gastro-enterostomy with clamps was done. Since this operation, which was done three weeks ago, the patient had not vomited, and had shown a steady gain in weight.

Dr. Tilton said this patient was shown mainly in the hope of bringing out a discussion as to the choice of operative procedure between a pylorotomy and gastro-enterostomy in these cases. To the speaker it seemed that in the absence of any signs of malignancy, a gastro-enterostomy was preferable, as it was by far the safer procedure and uniformly gave good results in this class of cases. Should symptoms

of beginning carcinoma develop, a subsequent pylorotomy could always be done, providing the patient was kept under observation. This had become necessary in only one of the speaker's cases.

DR LILIENTHAL said that in dealing with these cases he was strongly in favor of doing a preliminary gastro-enterostomy, either through the median line or to the left of the median line, and making a careful examination of the pyloric region, using rubber gloves and putting no gauze in the abdomen. Then, after an interval of two or three weeks, the pylorus should be removed. By that time the tumor would be much smaller and he could recall cases in which inflammatory growths the size of a duck's egg had disappeared spontaneously. By doing an additional pylorotomy we obviated the possibility of subsequent cancerous degeneration, and by doing the operation in two stages the mortality was largely reduced.

DR KAMMERER said he was not quite in accord with Dr Lilienthal on the question of doing a primary gastro-enterostomy. He also could recall cases where inflammatory tumors had disappeared spontaneously after gastro-enterostomy in a few weeks. If we could differentiate an inflammatory thickening of the pylorus from a malignant growth at operation the two-stage procedure might be of advantage in cases of benign obstruction. He believed, however, when possible, a complete operation should be done in one sitting in cases of carcinoma of the pylorus, as he had become convinced on several occasions that a secondary resection might present additional difficulties.

ONE HUNDRED AND TEN CONSECUTIVE CASES OF APPENDICITIS WITHOUT MORTALITY

DR WILLIAM B BRINSMADE read a paper with the above title, for which see page 610.

DR ROBERT T MORRIS said the statistics given by Dr Brinsmade spoke for themselves and needed no comment. As late as 1904, in an article entitled "A Consideration of the Question of Drainage in Cases of Acute Appendicitis with Spreading Peritonitis," which was published in *The Medical News* (July 2, 1904), Dr L W Hotchkiss reviewed the work in this field of surgery in one of the hospitals in this city. His results were interesting. Up to the year 1898 appendicitis statistics showed a mortality of 31 per cent. After changing to methods which he had previously considered to be dangerous, in the same institution and with cases of practically the same character as those submitted to operation during the earlier period, he had an unbroken series of 72 cases with no mortality. Those figures were a fair representa-

APPENDICECTOMY WITHOUT MORTALITY

tion of our results in this field of surgery when changing from the principles of the third to the fourth era. Part of the work of Dr. Brinsmade still related to the third or pathological era from which we are now emerging into the fourth or physiological era.

In the line of suggestion rather than criticism, which in the face of Dr. Brinsmade's results was unwarranted, Dr. Morris said he did not think it was essential in dealing with a gangrenous appendix to make any great effort in the care of the stump. It could be neglected and left to take care of itself, nor did he think it necessary to isolate the peritoneum with pads. If, broadly speaking, we had less dread of the pus encountered in these cases and looked upon it almost in the light of an albuminous, nourishing fluid, frequently sterile, we would less often inflict unnecessary trauma in trying to get rid of it, and our results in the end would be better. With a small incision, rapid work, and as little manipulation as possible, even such splendid results as those reported by Dr. Brinsmade might be eclipsed.

DR ERDMANN said that in cases of ruptured appendiceal abscess, recent investigations that had been carried on with the peritoneal content outside the abscess area indicated that the bacilli were usually restricted to those coils in immediate proximity to the abscess.

DR JOHN A. HARTWELL said he felt that the intra-abdominal pressure was a very active agent in preventing the spread of pus from an abscess into the general peritoneum. If the abscess were carefully opened on the side toward the peritoneal incision the pus would flow in that direction and pads were not needed to prevent its dissemination. This did not apply when the abscess was completely localized in the peritoneal cavity, but not close to the anterior abdominal wall.

DR KAMMERER said that in some cases of appendicitis where a large abscess had been opened, it was difficult to locate the appendix and, on this account, inadvisable to make a search for the same in dense infiltrations. He had been struck by the ease with which the appendix could very often be reached at a later operation and removed, when the acute inflammatory conditions had subsided. An appendix, which at the first operation seemed to lie deep in the pelvis, would at the secondary operation be found immediately beneath the abdominal walls.

DR. MOSCHCOWITZ said that at Mt. Sinai Hospital during the past fifteen years they had taken cultures in every case of appendicitis. During some of these years they had operated on between 700 and 800 cases of appendicitis, and in most of these cases cultures were made, and so regularly had they received the report that one or the other of the pathologic bacteria were present that when they occasionally did

receive a report that the secretion was found sterile, they were inclined to attribute it to some error in the technic of taking the culture

DR EUGENE H POOL said that in cases where fluid was present in the pelvis Dr Brinsmade introduced two large retractors and attempted to get rid of the pus by turning the patient on his side to allow the fluid to run out. In preference to this method, if it was considered advisable to evacuate the pelvis, it seemed to the speaker more reliable and thorough to employ the suction apparatus, developed some years ago at the New York Hospital. By this method accumulations of fluid in the pelvis or elsewhere in the abdomen could be quickly removed with a minimum degree of trauma, the method eliminates the necessity for sponging with gauze, moreover, there is no danger of injuring the viscera. The last feature, Dr Pool said, should be emphasized because the somewhat limited adoption of the method appeared to be due to a failure on the part of many surgeons to appreciate that a properly constructed suction tip can be passed into the abdominal cavity without cupping or sucking the intestines or omentum. The features of the tip, which goes by his name, have been described in several articles, the most recent being *ANNALS OF SURGERY*, vol LVIII, 1913, p 537.

DR SYMS said that a few years ago such a report as the one made by Doctor Brinsmade would have been impossible

When Ochsner proposed his method of treatment he based his reason for it on evidence which he had gleaned from the statistics obtained from a number of prominent surgeons. According to him, these statistics showed that the mortality following operations for appendicitis ranged from 15 to 30 per cent in acute cases, and he laid down the rule that one should not operate in acute cases unless he could operate within the first thirty-six hours. He believed operation after that period to be excessively dangerous and he advised waiting until the patient had passed through that attack and could be operated on in the interval.

Dr Syms said that in his experience he had never had such a large mortality as that stated by Ochsner, that he had not had a high mortality in acute cases except in those cases in which there were no protecting adhesions and in which there was a spreading or general septic peritonitis. In former years this latter type of cases had shown a high mortality. But in acute cases with a localized process his deaths had been very few.

Recently he had published a paper setting forth an analysis of his work, comparing three different periods. His work at Lebanon Hospital formed the basis of these reports. For this purpose he had divided his cases into three different classes, first, the chronic or inter-

APPENDICECTOMY WITHOUT MORTALITY

val cases ; second, the acute cases with limiting adhesions ; and third, the acute cases without limiting adhesions but with spreading or general peritonitis His results in the first two groups of cases have always been good In the third class of cases, years ago the mortality was high, practically 100 per cent To-day the mortality is low, most of the cases being saved Dr Syms had always followed the rule of operating as soon as possible Formerly he used to attempt to cleanse the peritoneal cavity by sponging, flushing, etc Of late years he does nothing of the sort but operates as rapidly as possible, removing the appendix and introducing drainage Occasionally he employs suction, using a Pool tube, but he does not employ this as a routine His whole idea is to remove the appendix as rapidly as possible, inflicting the least possible amount of traumatism To this plan of treatment Dr Syms ascribed the reduction in the mortality rate in this class of cases Bacteriologically he had not been able to verify the findings of Dudgeon and Sargent He had not found dual organisms in his cases—simply one variety of bacterium being demonstrated as a rule

TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY

Stated Meeting, held April 6, 1914

DR JOHN H GIBBON, President, in the Chair

SPRENGEL'S DEFORMITY OF THE SHOULDER

DR J TORRANCE RUGH presented a boy, four years of age, one of a family of four children. The other three were normal. This boy when two years old was noticed to hold the left shoulder higher than the right but, never having complained of any pain, nothing was done until a short time ago. He first came to the Orthopædic Dispensary of the Methodist Hospital in March, 1914, and examination showed an undersized child of rather inferior mentality. The left shoulder was carried nearly an inch higher than the right, the normal curve of the neck on that side was much altered, giving the appearance of a short neck. The scapula was raised and tilted forward and could not be moved up and down. There was inability to raise the arm above the shoulder level or backward as freely as the right, but other movements were normal. Palpation showed a mass anterior and superior to the scapula which moved with the scapula. The posterior-superior angle also appeared fixed, so that scapular movement occurred about this point as a pivot. The spine appeared slightly deviated to the left side in the upper dorsal region, but was not fixed. The chest anteriorly showed prominence of the upper ribs to the right of the sternum, while the left side showed some flattening as in cases of left dorsal rotation of the spine. No other abnormalities were present in the body. A diagnosis of congenital elevation of the scapula (Sprengel's deformity) was made and a roentgenogram was ordered (Fig 1). This apparently showed a bony formation running from near the coracoid process upward into the neck, which was the mass to be felt by the fingers. It was thought at this time that this bony formation was the cause of the deformity.

Later, operation was performed, on April 28, 1914, at the Methodist Hospital. The bony mass was found to be a hooked scapula (upper border) which lay close to the deep neck muscles and quite high up. This upper edge was removed with forceps but the shoulder could not be brought down for any distance. The posterior-superior angle was

FIG 1

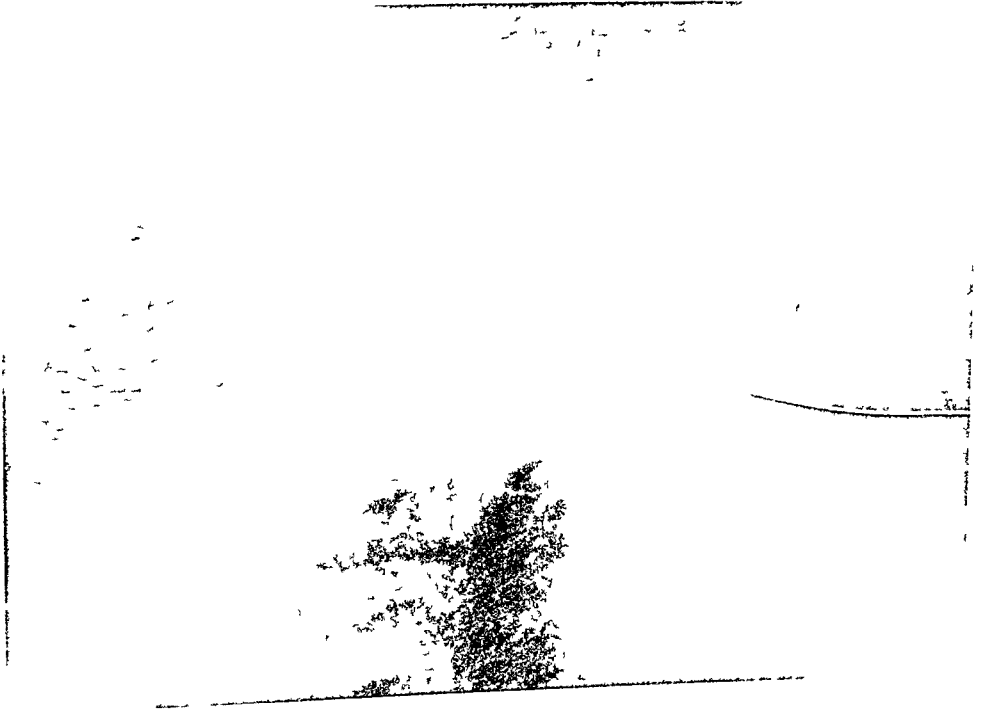
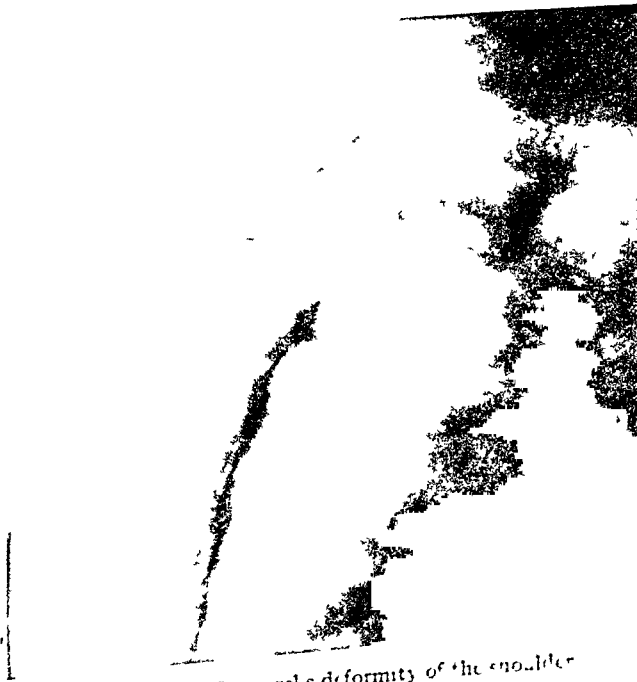


FIG 2



FIGS 1 and 2 — Sprengel's deformity of the shoulder

TRAUMATIC DISLOCATION OF THE HIP

then exposed by direct incision, and a distinct articulation was found to exist between that point and the tip of the seventh cervical spine. This latter was greatly elongated and turned to the left side as though it had been pulled over by the scapula. The roentgenogram also shows twisting of the lower part of the cervical spine to the left side and this accounts for the prominence of the anterior right ribs. Three-fourths inch of the spinous process was excised and the scapula freed from attachments. It was then easily pulled down to a level with its fellow. The incisions were closed with catgut and broad straps of adhesive plaster were used to pull the shoulder well down on the chest wall. Recovery was uneventful and a roentgenogram taken showed a quadrangular-shaped scapula lying in practically the same relation as its fellow (Fig 2).

Dr. Rugh also showed a case of a boy of five years of age who had received repeated injuries to the right shoulder. Marked enlargement of the upper end of the humerus resulted, with more or less limitation of function, but practically no pain. The diagnosis lay between exuberant callus (from possible fracture), a bone cyst and sarcoma, and the opinion of the Fellows of the Academy was asked regarding it. Roentgenograms taken at different periods were also shown.

It was the opinion of the Fellows that the case was one of bone cyst.

Dr. JOHN H. GIBBON, apropos to the Sprengel's deformity case, presented an X-ray plate of a child operated on by him a year ago, in which there was found a narrow band of bone running from the base of the spine of the scapula to the transverse process of a cervical vertebra. This bone was excised. An interesting point in this case is the cleft cervical vertebræ plainly shown in the plate.

Dr. ASTLEY P. C. ASHURST said that Dr. Gibbon's mention of the cleft cervical vertebræ reminded him of a specimen recently secured from an adult cadaver by a student at the University of Pennsylvania, in which the vertebræ were cleft and there was a bony mass running from the vertebræ over toward the scapula. Evidently no treatment had been required.

Regarding Dr. Rugh's second case he considered it a bone cyst, and that operation is indicated for removal of its contents, and partial obliteration of the cavity by crushing its walls.

TRAUMATIC DISLOCATION OF THE HIP

Dr. CARL R. STEINKE (by invitation) presented a paper with this title, for which see page 617.

Dr. P. G. SKILLERN, JR., said that before a traumatic luxation can

be spoken of, there are two postulates that must be fulfilled. These are that the capsule must be torn and the articular surfaces separated from each other. In the "central luxation of the hip," referred to by Dr Steinke, neither of these postulates is fulfilled. The capsule is telescoped, and the articular surfaces usually remain in contact. The correct term to apply to this injury is "perforating fracture of the acetabulum," and if the head of the femur has entered the pelvic cavity, "perforated fracture." The presence of the femoral caput in the pelvis is merely incidental, it being jammed in *after* the fracture of the acetabulum.

DR HENRY R WHARTON remarked that dislocation of the hip is very rare in children, and he could only recall one case in his experience, which occurred in a child about ten years of age from a heavy body falling upon him, resulting in a posterior dislocation of the hip. A complicated dislocation of the hip was brought to the Presbyterian Hospital, the patient was said to have a dislocation of the hip, attempts at reduction were made but the reduction could not be maintained. Examination revealed posterior dislocation with fracture of posterior lip of the acetabulum. In this case he succeeded in getting reduction and then maintained it by putting the patient up in plaster of Paris, with the thigh abducted, while still under the anæsthetic. The patient made a good recovery.

DR GWILYM G DAVIS thought that traumatic luxations of the hip are so infrequent that it is a wise thing to record individual cases, particularly as regards the difficulties which are experienced in handling them. One of the cases which was mentioned by the reader, of dorsal luxation, came to the hospital while he happened to be there, and therefore it devolved upon him to look after it, otherwise the resident might have been the only one to have observed it, the chief frequently failing to see luxations, particularly if of the type which is easily reduced. He, therefore, in this case, allowed the house officer to attempt the reduction with the patient on his back, under an anæsthetic. It failed. Then the patient was brought to the end of the bed, which was an iron bed without a footpiece, and allowed the limbs from the hips out to extend beyond the end of the bed. The uninjured limb was held horizontally by one assistant and the other assistant was directed to flex the affected thigh at a right angle to the body and the knee at a right angle to the thigh, the body then was horizontal, the thigh vertical, and the leg horizontal. While one assistant pressed downward on the calf of the leg, a second assistant made pressure on the head and trochanter and it gently sank into its socket. That is the Stimson method and in that case it worked.

beautifully Attempts to reduce many luxations are at first unsuccessful on account of the resistance of the muscles; of course this does not apply so much in luxation of the hip where the patient is anæsthetized.

Allis should be given credit for the work which he has done in this line, and particularly for two things, it was he who said that the innominate bone had its anterior and posterior surfaces divided into 2 planes by a line running from the anterior superior spine of the ilium to the tuberosity of the ischium He also proved the success of the direct method of reducing luxations His direct method is in the first place to relax all the tissues as far as possible, and then pulling or pushing the head of the bone in the direction of the socket, it is surprising in how many cases this method of reduction will be successful without the employment of great violence

When it comes to those cases in which difficulty is experienced the most common reason is because the luxation is complicated by fracture In the present day with the X-ray this point is capable of diagnosis On one occasion he was present during the attempted reduction of a supposed dislocation by several surgeons, it could not be satisfactorily accomplished and the case was later shown to have had a fracture of the edge of the acetabulum, so that the head would slip out as soon as replaced When it comes to the shoulder-joint, the fracture will frequently occur close to the joint line and then the fracture and luxation will be confounded and mistaken, one for the other

DR J TORRANCE RUGH mentioned the case of a man who had been thrown downstairs A dislocation of the hip was diagnosed and attempts made at reduction and a great deal of difficulty experienced in reducing it, but finally the head slipped into the acetabulum and the man was put in bed with extension and sand bags At the end of about three weeks the head had apparently slipped out of the acetabulum He was again anæsthetized and attempts at reduction were about to be made when suddenly the man became cyanosed and died Post-mortem examination revealed that the dislocation had been reduced, and that there was a piece broken out of the neck of the femur and a large mass of muscle tissue interposed between this fragment and both ends of the bone from which it was broken, so that no crepitation was present and no fracture had been diagnosed Death was due to a blood clot which became loosened in the femoral vein

Some years ago he had a case of thyroid dislocation which was brought down from the coal regions about four or five weeks after the injury, it was supposed to be a fracture, but the X-ray showed it

to be a thyroid dislocation and, at that time, reduction by manipulation proved absolutely impossible, so by the open method the head was reduced and a good result secured

CHRONIC CYSTIC MASTITIS

DR GEORGE P MULLER read a paper with the above title, for which see page 595

DR CHARLES H FRAZIER said that Dr Muller and he had been going over the results of this series, during the past year, and they had come to the conclusion, that in the future they would adopt the radical method rather than the conservation operation, that is, the complete removal and not the partial resection of the breast. He did not believe there will be much dissent on the part of surgeons as to the adoption of this general principle, though there may be some dispute as to whether the breast is removed subcutaneously with conservation of the nipple, or whether the breast together with the nipple is removed through an oval incision. As a matter of convenience the latter procedure will be preferred and may be in many respects the most satisfactory. As a general principle, the surgeon inclines to the operation which involves the least mutilation, and he had always thought, particularly where the breast on the other side was not very large, that the patient would be better satisfied if the nipple was not removed. For this reason in many of his cases the nipple has not been removed and a subcutaneous purse-string suture is introduced to prevent the nipple flattening out and becoming adherent to the chest wall. But in this connection it is interesting to hear that the patient who had the nipple conserved on one side and removed on the other preferred the latter procedure. While as a matter of routine frozen sections are made at the time of operation, the limited time afforded for the examination and the limited area of tissue investigated has led him to place little reliance upon the pathologist's report from the frozen section. If upon further study carcinoma is discovered, a secondary operation is performed for the removal of the pectoralis major and the other steps incident to a radical operation.

DR J S RODMAN said that during the last five years he had seen a good many of these cases of chronic cystic mastitis, perhaps between 50 and 60. The recent paper by McCarty is exceedingly interesting from the pathological stand-point, its chief importance is perhaps to correlate the clinical results with laboratory findings as has been pointed out. In the series of cases which the speaker had seen at his father's clinic the majority of those presenting small shot-like cysts with inky black fluid proved to be the ones that were the most prone to undergo

CHRONIC CYSTIC MASTITIS

malignant change There have been 6 instances of double cystic mastitis where operation first on one side was done, the patient returning later for operation on the other gland

There are one or two little points of interest in the diagnosis of this disease The superficial veins of the breast are rather apt to be prominent, and there is apt to be considerable pain at various times, particularly at the menstrual periods, at which time the patient also complains that the breast appears to be larger than at other times As to the treatment of chronic cystic mastitis, his father was now of the opinion that the best operation, particularly in women of the cancer age, is to do the complete operation for cancer He feels that removal of the muscle makes so little difference to the patient that it should always be done On the other hand, in very young women it is worth while to take a chance with the less complete operation, the resection being according to the plastic plan of Warren As to the frozen section, they always use it and had come to depend a good deal on it, in spite of the fact that in three instances which he could recall the frozen section has been wrong If the diagnosis of general cystic mastitis is returned, the gland is sacrificed, provided the woman is over thirty-five years of age

DR GEORGE P MULLER (in closing) said that the 18 cases reported by him were diagnosed in the laboratory as chronic cystic mastitis and not as carcinoma with chronic cystic mastitis They have had 40 or 50 cases during these 10 years which were diagnosed clinically as chronic cystic mastitis but in which the laboratory examination revealed carcinoma These are filed under the cancers In none of the cases traced has there been any development of cancer, there has been a recurrence of cystic nodules when partial resection had been done and some of these required a second operation One cannot say in all cases of chronic cystic mastitis from the clinical examination alone whether carcinoma is or is not present It can only be done by the most careful microscopic examination Last year Syms reported, before the New York Academy of Surgery, a case operated on for chronic cystis mastitis but in which later examinations revealed carcinoma, Hartwell and Lee reported similar cases For this reason he believed that complete amputation of the breast and a dissection of the axilla is indicated in all women over thirty years of age, in acute appendicitis we know that most of the patients will get over the attack under non-surgical treatment but we never know in the individual case before us whether he will get well or progress to gangrene, etc It is so in chronic cystic mastitis, we do not know whether the breast contains cancer or not He also wished to refer to the frequent criticisms of the laboratory diagnosis by sur-

geons of little pathologic experience Microscopic diagnosis is not any more exact than a clinical diagnosis It is a matter, to some extent, of personal equation or of the experience of the examiner, and while the pathologist makes less mistakes than the clinician, yet he is more frequently criticised than the latter

INDICATIONS FOR AND VARIATIONS IN THE TECHNIC OF ECK FISTULA

DR MAX M PEET (by invitation) read a paper with the above title, for which see page 601

DR J E SWEET was somewhat inclined to disagree with Dr. Peet's view of von Eck's work, von Eck succeeded in having a dog live over a year, and that was 38 years ago

The operation is perfectly feasible and the results are entirely compatible with life, except in one point, the animals he had had living a long period, the longest being $3\frac{1}{2}$ years, died of evident cirrhosis of the liver Nevertheless, the operation is indicated for cirrhosis of the liver, it is certain that there is no other definite relief for the back pressure in this condition About a year ago last fall, he worked out on the cadaver a method of doing the Eck fistula, consisting in the anastomosis between some of the radices of the portal vein and the iliac, and found it was very easily accessible and easy of accomplishment Thereupon, Dr Edward Martin and he, in his service at Blockley, attempted it twice It seemed that the indications were perfectly clear in each case, in the first they opened the abdomen supposedly for cirrhosis of the liver, but found this diagnosis to be incorrect, there being a condition of syphilis of the liver and spleen The Talma operation was performed In the second case they were unable to exactly determine the condition but it was also thought to be syphilis

DR CHARLES H FRAZIER referred to his own experience with omentopexy His first Talma operation was analogous in one respect to his first Edebohls's operation, both were suitable cases and in both the results were extraordinarily brilliant The patient was a middle-aged man, alcoholic, with marked cirrhosis of the liver and with no organic changes in the kidney or heart Although he had to be tapped two or three times after operation, from that time on for five years, when he lost track of him, the ascites did not return He had performed the Talma operation on four or five cases since then, but in none of these did he now recall, has there been any striking relief for the condition for which the operation was performed

With regard to the indications for, or the preference for, the Eck

OSTITIS FIBROSA CYSTICA

fistula over the Talma operation, it seemed to him that in suitable cases they would be justified in recommending the Eck fistula, provided it can be done by those experienced in blood-vessel surgery. In the case of a young woman, from whom he had removed the spleen a year ago for Banti's disease and who had developed secondary changes in the liver with marked ascites, after careful consideration, they decided to make an Eck fistula, but at the operation the adhesions were so abundant and of such character, that they could not expose vessels suitable for anastomosis. As to the operation requiring the hands of a surgeon experienced in blood-vessel surgery, he had had the opportunity of assisting Dr. Peet several times in Eck fistula operations on animals and had been surprised to find with what facility the operation is performed by experienced hands. In the human subject as in dogs, it ought to be attended with no shock and with no infection. The operation is of short duration and the mortality should not be higher than that of the Talma operation, which necessitates so much intentional trauma of the peritoneum.

DR ASTLEY P. C. ASHHURST asked if experimental surgeons have succeeded in producing ascites by obstruction of the portal vein. Theoretically, this will produce enlargement of the veins in its distribution on the mucous surfaces of the gastro-intestinal canal, but will not produce ascites. Hale White, Rolleston, A. O. J. Kelly and others have maintained that a patient with uncomplicated cirrhosis of the liver never lives long enough to be tapped more than once, in other cases the ascites may be due to changes in the peritoneum, perhaps tuberculous, or possibly syphilitic, or due to some other infection. Therefore, the establishment of an Eck's fistula seems an irrational procedure for the relief of ascites, and the relief of the ascites, which sometimes follows epiploxy, probably is not due to the establishment of a collateral circulation, but to the trauma to the peritoneal surfaces which is an essential part of Talma's operation. The indication for the establishment of a collateral circulation is gastro-intestinal hemorrhages, and not ascites alone.

OSTITIS FIBROSA CYSTICA

DR L. H. LANDON (by invitation) read a paper with the above title, for which see page 570.

DR GWILYM G. DAVIS said that once, years ago, he operated on one case of cyst of the lower end of the ulna by curetting and it has remained well. The subject is comparatively clear when there is a single cyst of the bone, but it becomes more obscure when it is one in which

the outlines are not so circumscribed and the tissues become, so to speak, rarefied, in other words, instead of being in two or three large vacuoles, there is a more disseminated rarefaction and also when it advances a little further and involves the outer edge with a possible involvement of the periosteum. Take the cases, for instance, of Paget's disease, of *ostitis deformans*. They seem to be closely allied to *ostitis fibrosa*. He remembered reading two or three years ago the report of an Italian case of Paget's disease limited to a single bone like the femur, and he thought, in Dr Henry Ling Taylor's book on orthopædic surgery, there is an allusion to Paget's disease being limited to more or less distinct bones and not being a general affection. In such a case it would be pretty hard to make a diagnosis not as to the condition exactly, but to classify it, these cases seem to shade one into another all the way from the simple single cyst to the rarefaction of Paget's disease.

THYROID OPERATIONS AND HYPERTHYROIDISM

DR CHARLES H FRAZIER read a paper with the above title, for which see page 583.

DR GEORGE P MULLER believed that too much emphasis is laid upon the preliminary medical treatment of exophthalmic goitre by most of the writers and text-books on the subject. It seemed to him that those cases seen early, before the so-called four cardinal symptoms are present, when mental irritability, general nervousness, loss of weight and strength and tachycardia may be the chief evidences of hyperthyroidism, may be completely cured by non-operative measures, of which rest is the key-note of treatment. In cases in which the diagnosis is established, it is an absolute waste of time in trying the so-called medical treatment for the three or four months advised by most writers.

BOOK REVIEWS

SURGERY OF THE VASCULAR SYSTEM By B M BERNHEIM, Instructor in Surgery, Johns Hopkins University 104 pages, 53 illustrations Philadelphia J B Lippincott Company, 1913

The author's purpose to furnish for those interested in this branch of surgery a concise practical aid to both experimental and clinical applications of vascular operative technic has been well accomplished

In the consideration of this subject chapters have been devoted to general technic, transfusion, end-to-end and lateral anastomosis, transplantation of segments, arterial and venous, reversal of the circulation for the prevention and treatment of gangrene, the treatment of varicose veins, surgery of the heart and aneurisms, and is concluded by an extremely valuable statistical study of aneurismal therapy A careful study of this commendable monograph suggests but one criticism and one that is not easy to overcome Every step advised in the text is of such actual consequence that it might be overlooked as unessential since all could not be emphasized Anyone who has attempted to do this work or who has seen the work of those who have become proficient can realize and appreciate the excellent manner in which the technicalities have been presented If there is one branch of surgery above all others in which a constancy of good results is dependent upon an irreproachable technic rather than upon a contest against time, it is in vascular surgery and only such as are willing to acquire and to preserve this rigid technic are justified morally in attempting its application to the human subject

In addition to being an excellent and impartial summary of the work done by others there are presented very ingenious methods devised by the author, notably in transfusion and in the reversal of the circulation by means of a lateral rather than an end-to-end arteriovenous anastomosis In a study of the treatment of aneurisms only the more acceptable methods are presented, the results of which are portrayed in the statistics contained in the last chapter

The illustrations throughout are excellent and sufficiently numerous to make every important point certain of understanding Altogether this book is not only instructive and suggestive, but also of distinct practical value

J. L. YATES

BOOK REVIEWS

BLOOD PRESSURE IN MEDICINE AND SURGERY By EDWARD H. GOODMAN, M D, Associate in Medicine in the University of Pennsylvania 12mo, 226 pages, illustrated Philadelphia and New York Lea and Febiger, 1914

The author has succeeded in this work in putting before the practitioner of medicine and surgery a brief, clear and authoritative book on the subject of blood pressure. In it one finds the physics and physiology of the subject sufficiently elaborated to convey an understanding of the principles. This is followed by successive chapters devoted to hyper- and hypotension, blood pressure in cardiovascular, renal, infectious and nervous diseases. Chapters are also given on blood pressure phenomena in obstetrics and in surgery, as well as conditions arising from disturbances in the gastro-intestinal tract and the internal secretory glands. The monograph is closed with chapters on the effect of drugs and other therapeutic measures on blood pressure and on the treatment of hyper- and hypotension. The style is simple and direct and the introduction of many illustrative diagrams forms an important feature of the work.

JAMES T. PILCHER

RADIUM AND RADIOTHERAPY By WILLIAM S. NEWCOMET, M D, Professor of Rontgenology and Radiology, Temple University, Medical Department. 12mo, 315 pages, with 71 illustrations and 1 plate Philadelphia and New York Lea and Febiger, 1914

In view of the extraordinary interest which has developed lately in the subject of radio-active substances, it is of interest to have the present knowledge on the subject brought together under one cover. In this small volume the author has first considered the question of what radium actually is, its nature, physics and chemistry, while the second part of the book details its use in all the diseases in which it has been found of value and gives full directions for its application.

JAMES T. PILCHER.

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BILIARY SURGERY

FROM JANUARY, 1910, TO APRIL 10, 1914, WITH AN ANALYSIS OF 270 CASES

By JOHN F. ERDMANN, M D

OF NEW YORK CITY

PROFESSOR OF SURGERY IN THE NEW YORK POST-GRADUATE SCHOOL AND HOSPITAL

DURING the period of time covered by this paper, 270 patients were operated upon, with 13 deaths, a mortality of 4 + per cent. The majority of these patients were subjected to operative interference upon more viscera than the gall-bladder alone, or the gall-bladder and duct were interfered with, thereby insuring a greater risk as to mortality than individual operations would give.

It is with a view of presenting the causes of death and the operations done that I offer this paper.

Age This varied from 22 to 74 years

Sex The number of patients in whom the sex is recorded is 242, of these, 154 were females and 88 were males—rather a sharp contrast to the records of Whittemore of Boston, published in the *Boston Med and Surg Jour*, October, 1913. He reported a series of 595 cases in which there were 441 women and 154 men, almost three times as many females as males.

Type of disease My records show 54 cases of acute cholecystitis; 34 cases of gangrenous cholecystitis, and 115 cases of cholecystitis not otherwise classified—this series included all varieties, from non-inflammatory to hydrops. There were six cases of perforated cholecystitis, six non-calculous, four malignant, and eight cases of hydrops, cholangitis 23 cases. In addition, acute hemorrhagic pancreatitis, with supuration or sloughing, was observed 6 times.

The operations recorded were as follows: Cholecystostomy, 125 cases, with 5 deaths. Cholecystectomy, 96 cases, with 4 deaths. Choledochotomy and transduodenal choledochotomy, 5 cases in all with 2 deaths. Cholecystostomy, with choledochotomy, 17 cases, with one death. Cholecystectomy, with choledochotomy, 27 cases, with one death. Cholecystotomy, with and without combined operations upon the duct, 142 cases, with 6 deaths. Cholecystectomy, with and without combined operations upon the ducts, 123 cases with 5 deaths.

Here it will be well to note the relative mortality rates in these two types of operations as a prognostic factor in advising their performance. In the so-called lesser mortality type of operation, cholecystostomy, with and without combined operations upon the ducts, I report 142 cases, with 6 deaths, a mortality of 4.2 per cent, while in the graver operation of cholecystectomy, with and without combined operations upon the ducts, I report 123 cases with 5 deaths, a mortality of 4.1 per cent. Attention is also called to the difference in the results after cholecystostomy alone, 125 cases with 5 deaths, and after cholecystectomy alone, 96 cases with 4 deaths, in both the mortality being less than 4 per cent.

Choledochostomy, singly or combined with operations upon the bladder, was done in 49 cases, with 4 deaths, about 8 per cent. If the choledochostomies, without additional bladder operations, be considered, the mortality in this series is exceptionally high, 5 choledochostomies of this class being done with a mortality of 2, or 40 per cent. These two deaths are easily explained: one occurred on the fourth day from embolism, and the other was due to a compression (interstitial fibrosis) of the liver cells in a patient 65 years old, in whom I opened the common duct, with negative findings, four years after a primary cholecystectomy and choledochotomy for pronounced cholangitis. Added to the cellular change in the liver in this case was a marked nephritis, which was the final cause of her dissolution, as there was almost complete anuria for four days preceding her death.

Secondary operations Under this term I include those patients who were operated on a second or a third time—not those considered as two-stage operations. I can find the histories of but 8 such cases in a series of 270, and these I will mention briefly. All were operated on by surgeons of repute, and I have no reason to doubt that the operations were as complete and thorough as the circumstances permitted. The following case presents a point of interest as to the length of time necessary for stones to grow to some size.

Mrs. B. was operated on six years ago in one of our large hospitals, a cholecystostomy being done. She remained free from pain for about two years. Then all her former symptoms recurred with increased severity, and there were signs of duct involvement. I then operated on her, exposing a very long, adherent gall-bladder containing 33 stones, none of them smaller than a marrow-fat pea. Four stones about the same size were also found in the common duct. A cholecystectomy and choledochotomy were done, together with the removal of the appendix. The patient made a prompt recovery, with no recurrence of any kind up to the present time.

It is but fair to the operating surgeon in this case to assume that in a case of election, as this was, we can preclude the possibility of his leaving 33 large stones in the gall-bladder. Therefore, either these stones were conveyed as fairly sized ones from the liver into the bladder, or else the growth of stones in the gall-bladder can be very rapid. The common duct invasion must be considered by itself, as this part of the hepatic system was not operated upon at that time. We are all aware of the presence of hepatic stones, and in view of this established fact, I advance the above argument as to the possible migration from the liver to the gall-bladder.

The second patient in the series was a young woman who was operated on a year ago for an acute gangrenous (?) cholecystitis. No stone was found at the time. She came to me with a persisting fistula, and upon exposing her gall-bladder, a stone the size of a robin's egg was found. This stone, I am quite sure, was overlooked at the first operation. A cure was established in two weeks by doing a cholecystectomy.

The third patient was a physician in whom a cholecystostomy was done hurriedly two years ago in the Presbyterian Hospital for a suppurative condition, and, owing to profuse hemorrhage from the surrounding tissues, packing was resorted to. Two years later he again developed marked symptoms. With great difficulty I was able to do a successful cholecystectomy, with an appendectomy.

The fourth case was one of my own. The patient was a female, twenty-two years old, with an acute hemorrhagic pancreatitis. In addition to establishing very liberal drainage, I did a cholecystostomy, removing many stones, some of them the size of a marrow-fat pea. Speedy recovery took place, the drainage wound healing promptly. Only recently, about three years later, I was compelled to explore her for abdominal pains similar to those she had had before her first operation, with the result of finding an atrophied and contracted gall-bladder containing mucopus and an amber-colored stone, entirely different from those originally removed, and about the size of a very large marrow-fat pea, impacted in the cystic duct. A cholecystectomy and appendectomy were done, and speedy recovery followed.

The fifth patient was one in whom a rapid cholecystostomy was done twenty months ago in one of our large hospitals, by a man of very extensive experience. When I saw the patient, she said she had had a period of eleven months' freedom, and then all her symptoms of a stone in the duct recurred. At this time the patient had a temperature of 103.6° and was profoundly jaundiced. An immediate operation revealed a small, purulent bladder and one large duct stone. Upon opening the common duct, no

bile escaped; in fact, acholia persisted for fifteen hours, and then only the slightest evidence of bile was present. Twelve hours later, however, bile began to flow in fair amount. In this case a cholecystectomy, choledochotomy and appendectomy were done, and the patient made an excellent recovery.

The last of the series I wish to report was in a Catholic priest of about forty years who was an athlete and worked hard in his parish. When I saw him, in consultation with Dr Ludwig Kast, he said he was suffering from pain in his abdomen, similar to that in a previous attack, for which he had been operated on thirteen months before. That operation, I was informed, was a cholecystostomy and choledochostomy. Conditions arose that demanded an exploration. A cholecystostomy and choledochotomy were again done, retaining the gall-bladder because the common duct was very much thickened (cicatricial), and a chronic pancreatitis existed. The fact was kept in mind that it might be necessary at some future date to do a cholecystenterostomy.

This patient went through the most profound manifestations of shock and collapse for four days that it has ever been my misfortune to see, showing all the evidences of a severe toxæmia, similar to those observed in acute pancreatitis. It is now about one year since his second operation, and no biliary symptoms have been complained of.

Combined or additional operations other than those of the hepatic system

Appendectomy Over ten years ago I called attention to associated disease of the appendix, using the unfortunate term "dual disease" instead of coincident or associated. This fact was well borne out by the second operation upon one of our well-known western surgeons while on a visit to the east during the past few years. I always remove the appendix when the patient's condition permits it, or when the infection can be limited to the gall-bladder zone. In this series, I have done appendectomy with cholecystostomy 67 times, with cholecystectomy 49 times, with cholecystostomy and choledochostomy 6 times, and with cholecystectomy and choledochostomy 15 times, making a total of 137 appendectomies in the entire series, over 50 per cent. Of the above number, it happens that the appendix has occasionally been the primary offending member, and the gall-bladder the secondary. One patient with a gangrenous appendix gave a history of gall-bladder trouble for years, she was also two months pregnant. She had an appendectomy and cholecystostomy done without disturbing the pregnancy. In one case a Finney operation for pyloroplasty was done, and in one a gastroenterostomy with choledochostomy. A partial gastrectomy for car-

cinoma, with cholecystectomy and choledochotomy was done in a woman who was afterwards shown at a meeting of the New York Surgical Society. In this case, three years before, I had done a right nephrectomy, a right oophorocystectomy and an appendectomy. This patient is living to-day, her second year terminating in two months.

Gastro-enterostomy for duodenal ulcer was done in two cases. A gastrotomy for ulcer on the posterior wall of the stomach was done in one case. In one case there was gastric carcinoma. In ten cases there were uterine and ovarian operations not requiring hysterectomy. In one of these there was a large cyst with a pedicle twisted several times. In seventeen of the cases the operation was associated with hysterectomy for fibroids. I have found the gall-bladder involved frequently in recent years in this condition, and, in my opinion, the patient's convalescence is scarcely retarded by these associated operations that are indicated.

In six of the cases there was an acute pancreatitis in the hemorrhagic, suppurative or sloughing stages of the disease. Five recovered. In all of them a cholecystostomy had been done. One, previously cited, was operated on recently, doing a cholecystectomy. In one there was a mucous fistula which persisted for two years and then healed spontaneously.

Carcinoma of the papilla of Vater was observed once. This patient was operated on twice, first a cholecystostomy and subsequently a cholecystenterostomy being done. This patient has also been shown at a meeting of this Society.

Perforated typhoid cholecystitis. In one of the cases, a male, during the third or fourth week of his attack of typhoid fever, had a sudden onset of acute abdominal pain, with distention. When I saw him, on the following day, he was comatose, and a rapid exploratory operation for suspected perforation of the bowel revealed two large holes in the gall-bladder, with profuse peritoneal soiling with purulent bile-stained material. The wound was rapidly drained and packed and the patient was returned to bed in eleven minutes, quite moribund. He was unconscious for seven weeks, but finally recovered.

In February, 1903, I presented the subject of primary typhoidal perforations of the gall-bladder at a meeting of this Society, recording the history of a female patient, forty-six years old, with a successful outcome. In my article at that time I recorded the then available statistics of this complication of typhoid, and found that, my own case included, there were 34 in all, and that of these, four had recovered.

Hydatids. Two patients with this complication have been operated on by me in the past two years. In one, where I did a

cholecystectomy and choledochostomy, the hydatid was about the size of a hen's egg. It was located in the liver at the sulcus of the suspensory ligament and was easily excised intact, with secondary suture of the liver. My second case of hydatids will be recorded under the fatal cases.

I have had one case of acute phthisis associated with cholecystitis gangrenosa. In this I did a successful cholecystectomy, but within less than one year jaundice occurred and colic recurred. A further operation was then deemed inadvisable. This was some three months ago, and I have not seen the patient since.

Hæmolytic jaundice. This patient was a young man of twenty upon whom I did a cholecystostomy for suspected cholecystitis, followed in six months by a splenectomy. The latter operation was done about three months ago with entirely satisfactory results.

A subphrenic abscess occurred in six of my series, with one death. This fatal case is the same one recorded under complicating hydatids.

Transduodenal operation. This operation has been done by me three times in my career, successfully in each instance. With the advent of the Blake forceps I feel the necessity of this procedure has been passed, as with the ordinary choledochostomy opening we can, with this instrument, grasp and remove with or without crushing all stones, even when well impacted in the papilla of Vater.

Morbidity and secondary operations. These questions cannot be reported definitely until some clearing house method is established of reporting to the original operator the patient's condition and the necessity for further operations, etc. When some such method is employed, data that is of value to all, particularly to the prospective patient, can be advanced.

Deaths. In 1910, out of a series of 43 of these cases, no deaths occurred.

In 1911 there were 54 operations, with four deaths. The first of these was a widow of fifty with general streptococcæmia. A cholecystostomy was done in the hope that some benefit might follow, particularly as the patient was slightly jaundiced. Death resulted from a septic endocarditis, the patient surviving the operation by several days. It is possible, indeed more than likely, that in this instance an unnecessary operation was done, but it is not probable that it hastened the patient's death.

The second death in the series was that of a Polish Jewess, well advanced in years and enormously fat, with double inguinal and an umbilical hernia, all of large size. She came under my

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care with a general peritonitis, her illness dating back about ten days. A fairly clear gall-bladder history was obtained. Operation revealed a large perforation in the gall-bladder, with pus and bile free in the peritoneal cavity. This patient was apparently on the road to recovery when a fatal pneumonia supervened.

The third case was one of acute hemorrhagic pancreatitis in a man, fifty-five years old, with an illness of ten days' duration. He was moribund when a cholecystotomy was done and many stones removed. Death occurred within thirty-six hours.

The fourth case was that of a man over sixty, upon whom a choledochostomy and cholecystotomy were done. Death followed on the seventh day from embolism, while he was engaged in a fierce argument with his son, a physician, about the necessity of continuing his special nurses.

In 1912 there were 63 recorded operations, without a death. In 1913 there were 78 recorded operations, with 6 deaths, 2 of them after cholecystostomy.

The first case was that of a man, thirty-eight years old, who had dilated veins and varicosities to such a degree that merely rubbing the exposed mucous surface of the gall-bladder would be followed by a profuse hemorrhage. The veins in the vicinity of the pylorus and stomach were three-quarters of an inch in diameter. Death occurred on the fourth day, and was attributed to acute gastric dilatation.

The second case of this series was that of a man, fifty-five years old, with cardiac myositis, which proved fatal. In this case the operation showed a perforated gall-bladder, with a mural abscess containing air.

The third case was that of a woman of sixty where death followed a choledochostomy done erroneously for supposed duct obstruction which proved, upon microscopical examination of the autopsy specimens, to be a cell destruction by interstitial hepatitis. This patient had been operated on by me some three years before for a profound streptococcus cholangitis. A cholecystectomy and choledochostomy were done, with a stormy convalescence and prolonged drainage, followed by a condition of health far better than she had enjoyed for fifteen years. After three years she had a sudden recurrence of her jaundice, and at the second operation the bile flowed perfectly clear and in fair quantity. While apparently progressing favorably, an acute nephritis supervened upon a chance renal impairment, with fatal result.

The fourth case was that of a man, fifty-five years old, with a suppurative cholecystitis, a pericystic abscess, empyema, and a suppurative hydatid cyst. This patient had suffered from jaun-

dice, with an intermittent temperature, for seventeen days, and was much emaciated. Operation revealed a perforated gall-bladder, with two well-localized abscesses, one on each side of the gall-bladder. Owing to the patient's serious condition, drainage only was done. Several days later, as the temperature still remained high, an exploratory aspiration of the chest was made and eight ounces of purulent fluid withdrawn. The following day a section of rib was made, and a few ounces of murky fluid evacuated. It was then seen that what had been regarded as a typical empyema was a lesion involving the dome of the liver, and, upon puncture, over a quart of hydatids in most foul colon communis pus was evacuated. Death followed from exhaustion about two weeks after the operation.

The fifth and sixth cases, one a man fifty-five years old, and the other a woman of seventy-four, both died of nephritis, the first after a cholecystectomy and the second after a cholecystostomy.

In 1914, up to April 10, there is a series of 26 cases, with 3 deaths. The first was that of a woman with well-advanced symptoms who died from nephritis after a cholecystectomy. The other two patients were males, aged fifty-five and fifty-seven years, respectively. The first was much emaciated and deeply jaundiced, with skin the color of mahogany. A choledochostomy was done and the patient died four days later from an embolism. The second patient had already been operated on for prostatic enlargement and his urine contained the bacillus coli communis. There was an intermittent temperature of the Charcot type. A cholecystectomy and choledochostomy were done, showing evidence of a pure streptococcus infection. The patient's temperature dropped from 103.6° to 99°, he developed a generalized maculopapular eruption (septic infarcts) and died on the eighth day.

With the citation of the fatal cases, as given above, I cannot feel that I have been responsible for a single death by doing any additional operative procedure, as it will be observed that of the thirteen deaths, but two of these patients had any complicating disease. The fourth death in 1911 was the result of pancreatitis, and was reported as such in a paper on pancreatitis published during the present year in the *New York Medical Journal*. The other, the fourth case that died in 1912, required the operations to which he was subjected, excepting the one for supposed empyema, as I am satisfied that my exploring needle must have tapped his hydatid abscess. Nevertheless, the suppurating hydatids were best approached through the transpleural route.

As a conclusion based upon these statistics, I am inclined to perform cholecystectomy more frequently than heretofore.

RETENTION CYSTS OF THE PANCREAS*

By JOHN SPEESE, M.D.

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THE patient, a male aged fifty-nine, was admitted to the University Hospital complaining of pain in the upper abdominal region. He states that he noted a feeling of discomfort in the epigastrium six years ago, and at times suffered from pain which radiated from the epigastrium to the lower dorsal region. Coincident with the discomfort, he experienced a sensation of pulsation in the upper portion of the abdomen, and several months ago was able to palpate a mass in the midline above the umbilicus, in the situation where the pulsation was present. The mass would disappear for a time, then reappear, and of late has been present only in the standing posture. He has lost about six pounds in weight and has had several attacks of jaundice.

The patient is married, a laborer by occupation, does not use alcohol or tobacco, his appetite has always been good, there has been no discomfort after eating.

The physical examination shows in the epigastrium a pulsating mass which seems to blend with the abdominal aorta. There is no tenderness or rigidity.

Gastric analysis: Free HCl, 0, total acidity, 20, trace of lactic acid, occult blood, 0. The microscopic examination shows much mucus, starch granules and a few Oppler-Boas bacilli.

Urine examination was negative.

Blood: Hæmoglobin, 60, red blood-cells, 3,800,000, white blood-cells, 9900.

Operation (by Dr. Frazier) —A right rectus incision was made and on examination the stomach, duodenum and gall-bladder were found to be normal. In the folds of the gastrohepatic omentum a cystic tumor was found, the contour was irregular and the mass was about the size of a large peach. On the posterior aspect it seemed to be in relation with the vena cava and adherent to the head of the pancreas, so that in removing it a thin layer of pancreatic tissue was carried away with the tumor. The rent left in the gastrohepatic omentum was closed with a purse-string suture, leaving a small opening for a drainage tube.

The patient made an uninterrupted recovery and was discharged cured.

* Read before the Philadelphia Academy of Surgery, Mar. 4, 1914.

Pathological Examination—Specimen consists of an irregular nodular mass which measures 4.5 x 6 x 4 cm and weighs 85 gms. The external surface contains numerous cysts and has adherent to it portions of a thin, fatty membrane resembling omentum. Between the cystic areas the tissue is dense and contains numerous points resembling cartilage. On cross-section the specimen is seen to be riddled with cysts, the largest of which measures 2 cm in diameter, the lining is smooth, and the contents consist of a cloudy fluid. In the centre of the tumor, and surrounded by the multiple cysts, is a dense mass of whitish tissue which has the consistency of cartilage and contains several points of calcification.

Microscopic examination of sections removed from the wall of the larger cysts shows a pronounced fibrous overgrowth which surrounds and distorts the pancreatic tissues present. In some instances the acini are well preserved, but for the most part the fibrous stroma has altered the outline of the lobules to a marked extent. The individual acini and ducts are surrounded and separated by the fibrous overgrowth which has isolated small groups of acini. Islands of Langerhans are present, many of them appear normal and others are infiltrated with red blood-cells. The stroma for the most part is rich in cells but in some places it has undergone hyaline degeneration and contains few cells. With the exception of these areas it is well vascularized, the vessels having been recently formed and most of them are congested. In the centre of the specimen the glandular tissue practically disappears, the tissue has a hyaline-like appearance and contains many points of calcification. In the areas in which the fibrous overgrowth is most intense, many of the acini show slight degrees of dilatation. The cysts are lined with epithelium which is cuboidal in shape in the small cysts and flat in the larger ones. The epithelial lining is composed of a single layer in many cysts, in others it is heaped up and in many of the larger ones the lining is entirely absent. The contents of the smaller cysts is composed of blood, and traces of blood-pigment are found in the fibrous stroma.

The fluid in the cysts is slightly acid, and microscopically contains debris, many erythrocytes and a few epithelial cells. The examination for ferments was not made, as the specimen was fixed in formalin soon after removal.

The gross features and the microscopic study of the specimen indicate that the cysts belong to the retention variety, and that the chronic pancreatitis is to be held responsible for the process. The history of repeated attacks of jaundice indicates that the pancreatitis may have originated in infection from the biliary passages. The presence of calcification in the cyst wall has been mentioned in the reports of other cases but is usually associated with the pseudocysts of traumatic origin.

Pancreatic cysts may be divided into four main groups. The proliferation cysts (adenocystoma), degeneration cysts, pseudocysts, and retention cysts.

The proliferation cysts are to be regarded as new formations, and are not common, as Kleinschmidt in 1907 collected 21 cases from the



FIG 1 —Retention cysts of the pancreas

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literature Lazarus states that the adenocystoma is the most common form of cyst, and believes that many cases are not recognized because, in the surgical treatment, the cyst is merely drained, and its true nature not appreciated. This statement is disputed by other writers, the majority of whom regard the traumatic pseudocyst as the most common form.

The epithelial and connective-tissue proliferation in the adenocystoma results in the formation of papillary projections into the cyst, the condition resembling greatly the cystoma of the ovary. When epithelial proliferation is demonstrable, the differentiation between the adenocystoma and other cysts is not difficult, but when the epithelial lining disappears, the differentiation becomes impossible in some cases. As a rule, however, the epithelium persists in the smaller and more recently formed cysts, although it has totally disappeared in the larger ones. The destruction of epithelium is probably due to pressure atrophy, as it seems unlikely that the pancreatic secretion would destroy epithelium and have no action on the surrounding connective tissue (Korte). Trypsin has never been found in the cyst contents, although in a few instances ferments reducing sugar and fat have been isolated.

The adenocystoma are most commonly found in the tail of the pancreas. In Kleinschmidt's 21 cases, 2 arose in the mid portion, in 4 the cyst involved the entire gland, and in the remaining the tail was the seat of the growth. The tumor is attached to the pancreas by a broad base, is rarely pedunculated, and is always surrounded by a firm, fibrous capsule which separates it from the pancreas.

The pancreas in a small number of cases is the seat of chronic inflammation, this is regarded by Lazarus as an important etiological factor, for conditions favoring stasis of secretion play a role in the origin of adenocystoma. It should be mentioned that stasis is more prone to occur in the tail of the pancreas where the proliferating tumors have their site of predilection. Chronic inflammation is rarely general and is limited to the parenchyma about the tumor. As the tumor is located in the tail of the pancreas almost exclusively, the remaining portion of the gland usually is free from disease and its function is undisturbed. The chronic pancreatitis associated with retention cysts, on the other hand, is diffuse in nature, involves much pancreatic tissue, interferes greatly with its function, and leads ultimately to severe disturbances in secretion and metabolism. We find, therefore, that adenocystoma is rarely accompanied by evidence of wasting or weakness, and that retention and other forms of cyst are prone to produce such symptoms.

In the differential diagnosis between adenocystoma and other forms of pancreatic cysts, Kleinschmidt calls attention to the following points:

The majority of adenocystoma occur in females, whereas both sexes are equally affected by the other cysts. The cystomata develop slowly, are progressive, produce no symptoms, there is no history of traumatism. A history of traumatism is elicited in 30 per cent of the other cases. In these digestive disturbances are common, the course is rapid, there may be intermittent enlargement or actual temporary disappearance of the tumor. The subjective symptoms differ greatly, being absent or slight in the cystoma, they are characterized by severe pain, loss of appetite, vertigo, constipation or diarrhoea in other forms. The general condition of the patient depends on the amount of pancreatic tissue involved by the cyst. There is little or no systemic disturbance in the cystomata, as the growth generally is confined to the tail of the gland. The traumatic and other cysts, however, usually are accompanied by loss of weight, strength and severe anæmia.

The prognosis is always grave. The development in some cases has been so slow that the tumor produced no symptoms, and was only discovered by accident. When the tumor begins to grow rapidly the danger of pressure on important surrounding structures and organs is great. When of large size and the pancreas is involved to a marked extent, alterations in nutrition arise and hasten a fatal outcome. Malignant degeneration is always to be feared.

The degeneration cysts are secondary to various inflammatory and neoplastic processes in the pancreas. Lazarus has found that toxic processes and various infectious diseases, as well as the softening of malignant tumors, are instrumental in producing this form of cyst. Autodigestion of effusions, especially when followed by indurative lesions about the hemorrhage, are responsible for the production of degeneration cysts of traumatic origin.

Injuries to the pancreas followed by hemorrhage can cause four different lesions according to Lazarus.

(1) Indurative pancreatitis, which possibly can lead to formation of true retention cysts.

(2) "Endopaneareatic pseudocyst," the formation of which is the result of autopeptic and inflammatory processes.

(3) Degenerative cysts following fat necrosis.

(4) Hæmatoma of the pancreas and omental bursa (peripaneareatic pseudocyst).

Pseudocysts are formed from hemorrhagic effusions into the tissues surrounding the pancreas, and almost always follow traumatism and inflammation of the gland. In rare instances autodigestion of encapsulated hæmatomas in the substance of the pancreas may be followed by

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cyst formation Rupture of the peritoneal covering of the pancreas permits both blood and pancreatic ferments to escape into the omental bursa The reactive inflammation causes connective-tissue proliferation and condensation, a cyst wall is thus formed When the pancreas is torn, the cyst may connect directly with the necrotic and degenerated gland tissue The cyst does not contain an epithelial lining, a fact of importance in differentiating pseudocysts from adenocystoma and retention cysts It should always be borne in mind, however, that the epithelium may have been destroyed by the action of pancreatic ferments The cyst contents is variable, although traces of blood can generally be found, either in the cyst contents or in the wall In many cases the fluid is clear, due to absorption of the blood, although cysts of long standing may have bloody contents due to erosion of the vessels, and consequent fresh hemorrhage There is little doubt that repeated hemorrhages into the cyst are responsible for its enlargement

A history of traumatism has been elicited in about 25 to 30 per cent of the cases Gobeil, in 230 cysts which were operated upon, found that a history of traumatism was present 76 times The symptoms appear in the majority of cases soon after the injury and are accompanied by severe pain and other symptoms indicating disturbance of digestion

Retention cysts arise either from the duct of Wirsung or from the smaller ducts and acini The obstruction of the duct is due to pressure, pancreatic calculi, stricture, etc., and is followed by stasis and dilatation, the cystic condition gradually extending to the main branches of the duct When the process begins in the small ducts or acini, obstruction to the outflow of secretion results in stasis and dilatation The cause of the obstruction, according to the histologic researches of Tilger, Diekhoff and others, lies in a preceding chronic pancreatitis The connective-tissue proliferation accompanying this process surrounds and compresses the pancreatic glands and ducts The stagnant secretion causes fatty degeneration of the gland cells, the ferments next act upon the pathologically changed wall, the membrana propria disappears by autodigestion, the interstitial tissues undergo necrosis and by confluence of many acini a small cyst is formed

The importance of chronic pancreatitis as an etiological factor in the production of retention cysts is recognized by most writers, the majority of whom regard the process as primary Lazarus endeavored to prove experimentally whether mechanical injuries by inducing interstitial inflammation caused cyst formation The pancreas was injured by direct trauma, vessel ligation or by the injection of irritating fluids The resulting connective-tissue proliferation especially involving the inter-

stitial tissues, caused compression of, and injury to, the acini, adhesions between the capsule and parenchyma, hyperplasia of the periductal tissues, and an active increase in the number of ducts. As a result of this cirrhotic process, the ducts were cut off and dilatation resulted. By producing subcapsular hemorrhage from trauma, and the injection of small amounts of iodine into the exudate, a reactive pancreatitis was induced and a cyst without lining, the size of a goose-egg, resulted. When a pancreatitis was not induced by iodine injection, the hæmatoma was absorbed and a scar resulted.

The formation of such pseudocysts is aided by the artificial production of pancreatic cirrhosis which favors stasis of secretion in the surrounding tissues. Following traumatism, therefore, pancreatic secretion escapes from the acini, the hæmatoma, the surrounding parenchyma and tissue shreds are digested. In the periphery a reactive inflammation leads to the formation of a capsule and further absorption is retarded by the chronic induration.

Lazarus gives the name of "intrapancreatic pseudocyst" to formations of this kind, the traumatism and cirrhosis being the important factors. Tilger and Dieckhoff believe, however, that hemorrhage into the parenchyma never causes cyst formation, and that when traces of blood can be demonstrated, the hemorrhage is to be regarded as secondary.

Honigmann states that endopancreatic cysts can arise in two ways through cystic transformation of hæmatoma arising in the gland parenchyma, or upon the basis of a chronic interstitial pancreatitis. In the first case the pancreatic ferments induce degeneration of the blood and tissues, and the cyst may reach great size if the normal resorptive ability of the pancreas is retarded. The experiments of Lazarus show that the reactive inflammatory processes in the surrounding tissues have a marked tendency to retard absorption. This form of cyst, as in the more common peripancreatic pseudocysts, occurs a short time after the injury is inflicted, and differs greatly from the chronic course pursued by the cysts secondary to chronic indurating lesions.

The chronic pancreatitis present in many of the cases reported has been secondary to systemic infections, such as syphilis, toxæmias, etc., or to local infection most commonly arising from the biliary passages. Honigmann points to the possibility of traumatism as a factor in producing chronic pancreatitis. The healing of many small foci of hemorrhage, with scar formation, and connective-tissue proliferation may directly cause sufficient contraction of tissues to cause stasis of secretion and dilatation, and thus produce retention cysts.

It seems feasible from these views to conclude that true retention

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cysts in the majority of cases are due to a preëxisting chronic pancreatitis. In most of the cases the pancreatitis follows some general infection, but, in rare instances, traumatism may invoke a local reaction which in turn leads on to the cyst formation

The author desires to thank Dr C H. Frazier for permission to record this case.

REFERENCES

- Kleinschmidt. Arch Naturw, 1907, 1, 177
Lazarus Zur Pathogenese d Pancreascysten
Tilger Virchow Arch, 1894, cxxxvii, 348
Honigsmann Deut Zeit Chir, 1905, lxxx, 19
Guleke. Ergeb. der Chir und Orthopedie, 1912, iv, 408.

CYSTIC LYMPHANGIOMA OF THE GREAT OMENTUM*

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THE question of cyst formation in the great omentum has been discussed to a certain extent in the literature, some 50 or more individual case reports, so far as I have been able to ascertain, having appeared to date, notwithstanding which the subject seems to be but very imperfectly understood, there are great differences of opinion with regard to the origin and significance of such cysts, and indeed comparatively few of the reported cases have been studied with sufficient care to permit of a definite determination of their point of origin and mode of formation. That the condition must be a distinct rarity is shown by the fact that only this half hundred so-called cases of omental cysts are available for study—and a number of these must on careful analysis be discarded—but it presents, nevertheless, several points of interest from both the pathological and clinical aspect.

My interest in the subject has been aroused by a case which came under my observation some months ago. The patient was a colored woman, thirty-four years of age, who was admitted May 5, 1913, to the Gynecæan Hospital, service of Dr H D Beyea, for the removal of a large tumor, which had been causing a noticeable increase in the size of her abdomen for about eight years. On examination, a hard nodular mass could be felt, extending well above the umbilicus, a diagnosis of uterine myoma was made, and was found upon opening the abdomen to be correct, the uterus itself being somewhat enlarged and multinodular, and having attached to its fundus an almost pedunculated tumor about the size of a man's head. There were numerous intestinal adhesions, and closely attached to the upper portion of the large tumor was the great omentum, which presented the remarkable cystic condition described below. The uterus, both tubes, and right ovary were removed, as was the great omentum, after ligation of the vessels close to the transverse colon. The left ovary and appendix appeared normal, and were not removed. The patient made an uneventful recovery.

Specimen—The uterus proper measures 9.5 x 8 x 8 cm, its surface is covered by extensive fibrous adhesions, and on section its walls are seen to contain numerous intramural nodules, varying in size up to 3 cm in diameter. The

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FIG 1 —Microscopic drawing of *onchocerca* 'c'



FIG 2 —Section through wall of one of the larger cysts



FIG 3 —Wall of one of the larger cysts showing numerous lymph spaces of various sizes lined with endothelial cells



FIG 4 —Section through the blood vessels seen traversing the central portion of the area in Fig 1 showing a cross section of the artery and vein surrounded by numerous small cystic cavities. Very low magnification.



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large tumor is roughly kidney-shaped; it measures 22 x 16 x 16 cm. Its surface is likewise covered in places by adhesions, and at one point it shows a roughened area about 4 cm. in diameter where it was attached to the fundus of the uterus. Microscopically, all the tumors show the characteristic appearance of myomata. Each tube has been transformed into a small hydrosalpinx; the right ovary contains a small corpus luteum cyst, but is otherwise normal, save for numerous adhesions on the surface.

By far the chief interest of the specimen centres in the *great omentum* (Fig. 1). This is a roughly quadrilateral sheet, measuring 20 x 18 cm. The central portion is thin and delicate, presenting the appearance of normal omental tissue, with very little fat. Around the entire circumference, however, are closely grouped masses of thin-walled cysts, which, when they first presented in the abdominal wound, resembled nothing so much as clusters of grapes. When the omentum had been fully exposed, however, it almost appeared as though a somewhat atypical segment of colon were attached completely around its free border, this appearance being furnished by the continuous masses of cystic bodies on the periphery. The cysts vary in size up to several centimetres in diameter, but on account of their extensive confluence it is not always easy to determine the exact size of any particular individual or group. The external surface of the cysts is for the most part smooth and glistening, the walls are thin and delicate, the contents clear, watery fluid. In addition to the larger cyst masses, which are limited exclusively to the periphery of the omentum, strings of much smaller ones are seen closely hugging one or two of the larger blood-vessels as they cross the central portion.

Microscopic sections through the cyst walls show these to be composed of rather loose connective tissue, containing numerous much engorged capillary blood-vessels, and a fairly intense and widely disseminated infiltration of small round cells. No fat is to be seen. Separating this connective tissue stroma from the cyst cavities is seen in every instance a single layer of flat cells, with distinctly staining nuclei, very strongly suggestive of the endothelium lining lymphatic channels (Figs. 2 and 3). These are present in the largest as well as in the smallest, and in all intermediate-sized cysts; in many places the thicker septa between the larger cavities contain numerous small, endothelial-lined spaces which almost certainly represent merely somewhat dilated lymph capillaries (Fig. 3), and since there is a continuous gradation between these and the largest of the cysts, the assumption seems strongly justified that the entire process has had its origin in a cystic dilatation of the lymphatic channels of the omentum, due to causes which will be discussed later. Still further evidence in favor of this etiology is furnished by examination of a cross-section through the blood-vessels with small surrounding cysts seen traversing the central portion of the specimen (Figs. 4 and 5). In this section we see an artery and vein, surrounded by a very small amount of loose areolar tissue, and then by a conglomerate of delicate-walled cystic cavities, each lined by the type of cells described above. From their structure and arrangement there can be practically no other interpretation of these spaces than that they represent much dilated perivascular lymph-channels. In most of the larger cyst cavities is seen a small amount of homogeneous material, which in eosin-haematoxylin preparations takes a diffuse pinkish stain.

The question naturally arises, as to whether the occurrence of this marked degree of cyst formation about the periphery of the omentum, the remainder of the organ being but slightly involved, and then only along the course of a main blood-vessel, can be in any way explained by the anatomical arrangement of the lymphatics. A careful search through more than a dozen of the more important works on anatomy¹ has failed, however, to bring to light a single description of the arrangement of the lymphatic vessels of the great omentum, nor does its blood-vascular system receive, in many instances, much better treatment. Many of the authors dismiss it with the bare statement that the gastro-epiploics give off descending branches which pass down into the omentum, what happens to them after they get there being left to the reader's imagination, in some instances, however, the statement is made that the descending branches pass down through the anterior layer of the omentum to the free border, and then turn upward in the posterior layer, to anastomose with vessels coming from the transverse colon. Likewise, in most of the drawings illustrating the vascular supply of this region of the body, the lower portion of the omentum is left out entirely, or if it is included, its vessels are represented merely as a few trunks, running straight downward, and after a few subdivisions, ending as terminal branches near the free border.

Norris, however, who has made a careful study of the finer structure of the omentum, goes into the matter somewhat more in detail. He says, "In some cases there are four main arteries which come down laterally on the sides of the omentum, two on the anterior and two on the posterior surface. More frequently, however, the organ is supplied by a central artery in the anterior, and a corresponding artery in the posterior leaflet. As a general rule, three distinct branches are given off from these vessels, which run transversely across the surface of the omentum. They are about an equal distance apart, the lowermost branch corresponding to nearly the lowermost portion of the omentum.

The arteries are accompanied by veins." The only drawing I have been able to find that brings out in any way this formation of a transverse vascular arc near the free border is one in Broesike's *Anatomic Atlas*, showing a distinct arcuate anastomosis between the vertically coursing blood-vessels just within the free border of the omentum (Fig 6). Although this vascular arrangement is undoubtedly of very

¹ Including Gray, Holden, Piersol, Cunningham, Morris, Gerrish, Quain, Deaver, Sobotta-McMurrich, Toldt, Rauber-Kopsch, Spalteholz, Testut, Poirier-Charpey, and Sappey.

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tions, although it occasionally involves the omentum in conjunction with other abdominal viscera—we find that some of the so-called cysts represent nothing but secondary degenerations of malignant tumors (Hasbrouk) or hematomas (Dowd, Simon), or sacculated collections of fluid following traumatic rupture of an abdominal viscus (Cotman). Others were only parasitic with regard to the omentum, having apparently arisen primarily in some other organ, such as the ovary (Waldy), and others, again, were merely secondary implantations in the omentum from malignant ovarian growths (Thornton). In one unique instance, the origin was probably due to a mycotic infection which had penetrated the walls of the intestinal tract (Ris).

For these various reasons, therefore, quite a number of the reported cases must be rejected from a discussion of cyst formation proper in the great omentum. Those that remain, and which may be considered *true cysts*, in that they represent, as far as can be determined, the result of actual proliferative or secretory processes, have for the most part presented clinically one of two chief types, although the dividing line is by no means a sharp one, and some cases occupy a distinctly borderline position. In some instances the omental tumor consisted of a single or but few loculi, was large and prominent, and was itself the cause of the patient's seeking surgical attention; in others, the cysts were small, multitudinous, and were scattered throughout the omentum, or chiefly about its periphery, as in the present specimen. In this type, the discovery of the omental condition has usually been incidental at operation or autopsy, no suspicion of its existence having arisen clinically. In the former type of tumor, however, the distention of the abdomen has often reached enormous dimensions, as in the one reported before this society a few years ago by Rodman. These cysts have developed at all ages, from earliest infancy to adult life; when occurring in infants and children, the preoperative diagnosis has almost universally been tuberculous peritonitis; when occurring in adults, either this, or in female subjects, ovarian cyst. Under these mistaken diagnoses repeated tapplings have been performed in a number of instances, but re-formation has invariably followed, eventually necessitating radical extirpation.

While a number of authors consider many of these larger as well as the smaller cysts of lymphatic origin, and, indeed, Jacoby maintains that all true omental cysts are of this etiology, a number of other explanations have been offered to account for them. Owing to their frequent occurrence in infants and young children, a congenital origin from embryonic rests between the layers of the omentum has been strongly advocated by some investigators. Of several cases so diag-

being found in the cellular tissue of both groins, in the velum interpositum, and in the pineal gland

Another case of some interest in this connection has been reported recently by Stillman. His patient was a woman of forty-two, whose abdomen had been increasing in size for about five years, at operation a pedunculated fibroid tumor the size of a man's head was found attached to the uterus, and also to the omentum by a vascular pedicle as thick as the thumb. "Distributed throughout the omentum were numerous elongated, tortuous, exceedingly thin-walled cysts, from $1\frac{1}{2}$ to 2 inches in diameter, showing a characteristic lobulation or sacculation comparable to that of the distended colon. The gastrocolic omentum was also affected, but to a much less extent, the dilatations here being much fewer and none larger than a lead pencil, they were unmistakably dilated and tortuous lymph-vessels." A second, strikingly similar case, reported by Fitz in an unpublished Lane lecture (San Francisco, 1910), is also referred to by Stillman. "It was a case of enormously dilated lymphatics of the omentum, occurring in a woman who also had a fibroid of the uterus, to which the omentum was attached. The omentum was reduced to a web of connective tissue supporting the tremendously dilated lymphatics."

It is not my purpose here to review in detail the literature upon omental cyst formation in general, since this has been done more or less extensively by practically every recent writer upon the subject. In 1911 Dowd was able to collect 37 cases which had been reported up to that time as cysts of the omentum, and his tabulation has formed the basis of most subsequent articles in this country, while in the German literature it has been taken over practically intact by Monnier, who in a recent extensive monograph has added 5 more, bringing the total (including Dowd's own case) up to 43. In addition, however, cases have also been described under the general designation of omental cysts by Frank, Giannettasio, Lipscher, Markoe and McPherson (3 cases), Thornton (2 cases), Buckley, Funk, and others, bringing the total number of instances known in which some form of cystic process has occurred in the omentum up to something over 50. The exact number is of little moment, however, and would be practically impossible of determination, for many of the descriptions are so meagre, and so lacking in essential details, that the cases to which they refer cannot be definitely classified. Moreover, even the most cursory perusal of these reports shows that they cover a distinctly heterogeneous group of pathological processes, many of which have practically nothing in common other than their anatomic situation in relation with the omentum.

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Another hypothesis that has been offered is that the cysts arise from the flat cells covering the serous coat of the omentum (Seefisch, Himmelheber, Karas), and represent therefore practically nothing more than loculated collections of peritoneal fluid. That cyst formation from the surface-serosa does occur in many of the abdominal and pelvic organs, especially the tubes and ovaries, is of course well known, the inflammatory factor here probably playing an important rôle. Karas, whose case quite closely resembles in some respects the one reported in this paper, makes a great deal of the fact that the cysts were lined with epithelial-like cells, many of which apparently showed in places the presence of *cilia*, structures which certain authors claim to have demonstrated as a normal constituent of the lining cells of the peritoneum. From this fact, Karas concludes that the cysts in his case were of peritoneal origin, he thinks, however, that this cyst formation on the part of the peritoneum was the result of some abnormality in the embryonic development of the omentum, since he could not find anything to suggest a post-embryonal occurrence, such as inflammation, notwithstanding the fact that a marked round cell infiltration was present in the cyst walls.

At first sight, this theory of origin was the one which most strongly suggested itself as the explanation for the occurrence of the cysts in the present instance, until more careful examination of the specimen led to the different conclusions stated above. To sum up, therefore, it may be said that while the possibility of the origin of some cases of true cysts of the omentum from embryonal rests, or from the surface peritoneum, cannot be positively denied, it may be considered demonstrated beyond any reasonable doubt that in other instances the lymph-vessels are the starting point for such growths, and this latter explanation would certainly appear to be the one which would apply in the majority of cases.

With regard to the diagnosis of omental cysts, there is not a great deal to be said. In view of the rarity of the condition and the lack of any distinctive symptoms, it is not strange that in only two or three of the reported cases has even a tentative diagnosis been made before

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opening the abdomen. Brandt claims to have diagnosed a large cyst of the omentum "by exclusion," and in one of Stillman's cases a pre-operative diagnosis of "either an omental cyst or an ovarian cyst with a very long pedicle" was made. The presence of a distinctly sacculated collection of fluid, not associated in any way with the genital organs, might, in the absence of any symptoms suggestive of a tuberculous condition, lead to the suspicion of omental cyst; beyond this, however, it is hardly possible to go with our present diagnostic resources.

The only rational treatment for the condition is extirpation of the cyst-bearing portion of the omentum. Tapping is of course, as has been stated, not only ineffectual, but may give rise to hemorrhages and adhesions, which markedly increase the difficulty of subsequent operation. It is possible that in a very occasional case drainage and marsupialization might be necessary, but with the present development of surgical technique, and in view of the excellent results which have followed the more radical type of operation in most of the reported cases, instances in which any other procedure would be indicated must be considered decidedly the exception.

BIBLIOGRAPHY

(All cases included in the tabulations of Dowd and Monnier, unless specifically referred to in the text, are omitted.)

- Brandt: Omentalcyste. *Norsk. Mag. f. Laegevid.*, 1893, No. 8, *Zentralbl. f. Gyn.*, 1894, xviii, 991.
- Broesike: *Anatomischer Atlas d. ges. menschl. Körpers*, Berlin, 1904, vol. ii, p. 355.
- Buckley: Dem. in Manchester Med. Soc. *Brit. Med. Jour.*, 1885, ii, 994.
- Cotman: Case of Omental Cyst Communicating with the Stomach, following Injury. *Brit. Med. Jour.*, 1902, i, 1267.
- Dowd: Cysts of the Omentum. *ANN. SURG.*, 1911, liv, 617.
- Frank: Omental Cysts. *Amer. Jour. Obstet.*, 1913, lxvii, 501.
- Funk: Cysts of the Omentum; with Report of a Case. *Surg., Gyn. and Obstet.*, 1914, xviii, 70.
- Gairdner: A Remarkable Cyst in the Omentum. *Trans. Path. Soc. Lond.*, 1852, iii, 374.
- Giannettasio: Cisti ematica dell'omento. *Gaz. degli Osped.*, 1907, xxviii, 939.
- Hasbrouk: Enormous Endotheliomatous Cyst of the Great Omentum. *ANN. SURG.*, 1908, xlviii, 206.
- Henke: Multipler cystischer lymphangiomähnlicher Tumor der Bauchhöhle. *Verhandl. d. deut. path. Gesell.*, 1899, ii, 251.
- Himmelheber: Zur Kenntnis seltener cystischer Bildungen in der Bauchhöhle. *Arch. f. Gyn.*, 1909, lxxxvii, 67.
- Jacobi: Cyst of the Omentum. *Trans. Ass. Amer. Phys.*, 1901, xvi, 232.
- Karas: Fall von multilokullärer Zyste des grossen Netzes. *Virch. Arch.*, 1907, clxxxviii, 67.

- Lipscher Orvosi Hetulap, 1901, No 15 Zentralbl f Gyn, 1903, xxvii, 92
 Markoe and McPherson Three Cases of Cysts of the Omentum Bull Lying-in
 Hosp, N Y, 1912, viii, 70
 Monnier In Prutz and Monnier, Die chirurgischen Krankheiten und die Ver-
 letzungen des Darmgekröses und der Netze Deutsche Chirurgie, Lfrng
 46k Stuttgart, 1913
 Norris, C C The Omentum, its Anatomy, Histology, and Physiology in
 Health and Disease Univ Penna Med Bull, June, 1908
 Ris Fall von Cyste des grossen Netzes Brun's Beitr z klin Chir, 1893, x, 423
 Rodman Omental Cyst Internat Clinics, 1909, 19s, iv, 125, ANN SURG, 1909,
 xlix, 427
 Seefisch Fall von grosser Cyste des Netzes Deut med Wochenschr, 1909,
 xxxv, 1790
 Simon Kyste hematique du grand epiploon Bull Soc Anat Paris, 1858,
 xxxiii, 30
 Stillman Lymphangiomata of the Omentum and Omental Cysts Jour Amer
 Med Ass, 1911, lvii, 726
 Thornton Mesenteric and Omental Cysts Brit Med Jour, 1882, ii, 1242
 Waldy Case of Suppurating Omental Cyst Lancet, 1889, ii, 642

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amination showed 7000 white blood-cells and 80 per cent hæmoglobin (Sahli) The urine in three glasses is clear in all It has a specific gravity of 1006, shows a small cloud of albumen but nothing microscopically Guaiac and acetone tests are both negative The phenosulphonephthalein test gives an output of 48 per cent after one hour and ten minutes by intramuscular injection Blood taken for Wassermann

Special Note—The penis is in a condition of extreme erection, slightly bowed down and to the right Movement in any direction causes considerable pain There is no urethral discharge The corpora cavernosa are tensely distended and hard, while in marked contrast the corpus spongiosum is flaccid and soft and the glans penis is small and compressible At the root of the penis the two ischiocavernosus muscles are felt to be rigidly contracted in a rope-like cramp, and are tender On the dorsum of the penis can be seen the scar of an old chancre The scrotum and its contents are negative The prostate is normal in size, shows no tenderness or nodules, and its secretion is negative Both seminal vesicles are palpable, but normal

The patient was admitted to the colored ward The galvanic electric current was applied to the contracted ischiocavernosus muscles with no effect Patient put to bed Ice caps applied to the penis and perineum Morphine gr $\frac{1}{4}$ (h) given every three hours

April 15 No improvement

April 16 No improvement Patient drowsy and asleep most of the time, but there is no change in the local condition even during deep sleep

Report of Wasserman reaction, positive

April 17 Morphine discontinued, 0.9 mg neosalvarsan given intravenously, and the patient put on a mixture of potassium iodide and bichloride of mercury (grs 5 and $\frac{1}{17}$ respectively) and hydrargyri cum cretæ (gr 1) q 4 h

April 18 During the night while the patient was asleep the penis became flaccid enough to fall over on the thigh, but so soon as he awoke it became erect and tense

April 19 There is a noticeable change in the distention of the corpora and of the rigidity of the ischiocavernosus muscles The penis hangs at an oblique angle to the abdomen and the patient now has no pain or discomfort

April 21 Salvarsan 0.4 given intravenously There is a marked change in the condition The penis is no longer erect, but hangs loosely against the body The corpora are, however, still somewhat distended

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- Lipscher: Orvosi Hetilap, 1901, No. 15. Zentralbl. f. Gyn., 1903, xxvii, 92.
- Markoe and McPherson: Three Cases of Cysts of the Omentum. Bull. Lying-in Hosp., N. Y., 1912, viii, 70.
- Monnier: In Prutz and Monnier, Die chirurgischen Krankheiten und die Verletzungen des Darmgekröses und der Netze. Deutsche Chirurgie, Lfrng. 46k. Stuttgart, 1913.
- Norris, C. C.: The Omentum, its Anatomy, Histology, and Physiology in Health and Disease. Univ. Penna. Med. Bull., June, 1908.
- Ris: Fall von Cyste des grossen Netzes. Brun's Beitr. z. klin. Chir., 1893, x, 423.
- Rodman: Omental Cyst. Internat. Clinics, 1909, 19s., iv, 125; ANN. SURG., 1909, xlix, 427.
- Seefisch: Fall von grosser Cyste des Netzes. Deut. med. Wochenschr., 1909, xxxv, 1790.
- Simon: Kyste hématique du grand épiploon. Bull. Soc. Anat. Paris, 1858, xxxiii, 30.
- Lymphangiomata of the Omentum and Omental Cysts. Jour. Amer. Med. Assoc., 1911, lvii, 726.
- Omental and Omenteric and Omental Cysts. Brit. Med. Jour., 1882, ii, 1242.
- Suppurating Omental Cyst. Lancet, 1889, ii, 642.

charged from the hospital 35 days after admission unimproved and with erection still present

January, 1913 Patient lost, not to be found at address given

NOTE—This case occurred in the practice of Dr A G Rytim, Baltimore, to whom I am indebted for the history

Discussion—The first case, in view of the immediate response to antisypilitic treatment, is most likely the result of some luetic lesion of the nervous system The striking feature in the case is the remarkable and prolonged spasm of the ischiocavernosus and the resultant partial character of the erection, the corpora cavernosa alone being involved This muscle spasm might result from continuous irritation or inhibition either in the brain or in the cord There was no evidence of any local genito-urinary infection which might cause spasm of these muscles through reflex stimulation Furthermore, priapism due to such reflex causes is usually recurrent and transitory, as in the early history of the second case Thrombosis, traumatic or infective, of the corpora is excluded by the early and relatively rapid subsidence, as well as by the observation that on the third night, during sleep, the condition was partially relieved, which would not have occurred if the cause had been local and mechanical

In the second case there had been many previous urethral infections and, as is common with such infections, many recurrent and transitory erections The prolonged attack was most likely the result of a secondary thrombosis of the corpora cavernosa, occurring in or following upon one of these reflex erections Conditions would be ideal for the formation of a thrombus infection, congestion and slowing of the blood stream and mechanical tension or injury The persistent prolonged character of the priapism coincides with this assumption

The Physiology of Erection—An understanding of the physiology necessarily precedes a logical consideration of the pathology of erection Normal erection is a reflex act, the immediate centre for which is assumed to lie in the lumbar cord This centre may be acted upon by descending or by ascending impulses The descending impulses come from a cortical centre in the cerebrum which receives its stimulation through the special senses (eyes, ears, nose) giving rise to erotic sensations and thoughts The ascending impulses arise in some part of the genital tract The glans penis is supposed to harbor the most sensitive of these afferent fibres, but the urethra, the spongy tissues of the penis, the prostate, the seminal vesicles, and even the bladder are all

PRIAPISM

REPORT OF CASES AND A CLINICAL STUDY OF THE LITERATURE WITH REFERENCE TO ITS
PATHOGENESIS AND SURGICAL TREATMENT

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TRUE priapism is a remarkable pathologic condition of prolonged and persistent erection unaccompanied with sexual desire, and usually painful. It is to be distinguished from the transitory nocturnal forms of recurrent erection, which are not uncommon in inflammatory conditions of the genito-urinary tract, and which are usually of slight significance and amenable to local treatment. True priapism, as a rule, responds to no form of medication, and subsides spontaneously, sometimes quickly, but usually very gradually. Its pathogenicity is varied and obscure. The condition is rare, there being only about 170 cases reported in the whole medical literature. The object of this paper is to report two new cases and to indicate, through an analysis of cases in the literature, a simple classification and a rational course of treatment.

CASE I.—W. L., a colored man of forty-five, stevedore by occupation, came to the Johns Hopkins Dispensary, Friday morning, April 14, 1913, complaining of having had an erection since 5 o'clock that morning.

At the age of 30 he had a chancre for which he took treatment for six months. He gives no history of secondaries. Married 22 years and has two healthy children. Family and personal histories are otherwise negative. Patient says that he and his wife had intercourse this morning at about 4 o'clock. After the act, which was normal, he did not feel satisfied and desired a second which his wife refused, and on this refusal he lays the blame of his present condition. He soon ceased to have sexual desire but the penis remained erect and began to ache. On physical examination there is found a pronounced arcus senilis in both eyes, enlargement of the axillary inguinal and epitrochlear glands, tortuous and thickened radials. The deep and superficial reflexes are all normal and a careful neurological examination by Dr. Taneyhill was negative. Neither the spleen nor liver are palpable. Blood-pressure is 165 mm. (Tycos). Blood ex-

I. Peripheral.

(A) Produced through nervous influences (reflex)

- 1 Through inflamed irritating conditions of the urethra and its glands
- 2 Through new growths or tumors of the anterior or posterior urethra

(B) Produced through mechanical causes in the spongy tissues

- 1 Through the spread of a disease process in the urethra into the spongiosum
- 2 Through the independent occurrence of local disease of the penis (a) inflammatory in nature, (b) neoplastic in nature, (c) traumatic in nature

II Central

(A) Through anatomical disease of the brain or cord

- 1 Traumatic in nature
- 2 Neoplastic in nature
- 3 Inflammatory in nature

(B) From functional disturbance of the brain or spinal cord

The general diseases producing priapism he subdivided into

I Peripheral

(A) Infectious diseases (tabes, lues, etc)

(B) Intoxications

(C) Constitutional and blood disease (leukæmia).

II Central

Intoxications.

The above classification, as well as those of Taylor, 1899, Pryce, 1903, Lohnstein, 1906, Blum, 1906, Terrier and Dujarier, 1907, and Laurent and Nové-Josserand, 1908, all of which are similar, though not nearly so complete, are too general for diagnostic purposes in the application of treatment, inasmuch as they are based upon etiologic rather than pathogenic considerations

The distinct nervous and circulatory mechanisms of normal erections, although complex, indicate a dual pathogenicity for the pathologic manifestation, and every case in the final analysis may be grouped as due either to a nervous or a mechanical factor, or, as in Case II, to a definite combination of these

A simple and practical classification of the cases of priapism, therefore, would be into

- 1 Cases due to nervous causes
- 2 Cases due to local mechanical causes

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April 23: Patient discharged. Penis is now permanently flaccid, but somewhat elongated and firm. He has had no return of erection.

August 29: Patient seen. Has had no return of erection but has had sexual desire, though much weaker than before the onset of the priapism, and ejaculation is only occasionally present after prolonged though infrequent attempts at intercourse. He has had no nocturnal pollutions.

NOTE.—This case was admitted to a ward of the Johns Hopkins Hospital in the service of Dr. Hugh H. Young to whom I am indebted for the privilege of reporting it.

CASE II.—W. D., negro fisherman, aged fifty-two, was admitted to Mercy Hospital, May 12, 1911, complaining of a painful erection which he had had for over 24 hours.

Patient has had pneumonia and typhoid fever, the last attack of gonorrhœa two years ago. Denies lues, although he says that he had a sore on penis at time of last gonorrhœa.

The onset of the present prolonged erection occurred suddenly in the night and was not preceded by sexual or alcoholic excess or by any apparent cause. The patient, however, had been troubled for several months previously with frequent and painful nocturnal erections accompanied with frequency of urination and nocturnal incontinence. Eighteen years ago the patient had an erection unaccompanied with sexual desire which lasted for several hours and then subsided spontaneously and quickly. Since then he has had other attacks of short duration at infrequent intervals and for which he knows no cause. Aside from some burning there has been no trouble in urination. On examination the penis is seen to be in complete erection and is very painful, particularly on movement. There is a slight glairy mucous discharge from the meatus. First urine glass is clear, second one cloudy. Back of the corona is seen the scar of an old sore. Inguinal glands are slightly enlarged. Testicles, epididymis and prostate, normal. Atrophic scars on anterior surfaces of the tibia. Pupils are irregular but react to light and accommodation. Patellar reflexes are active on both sides.

May 15: Condition about the same. Given potassium iodide and lepullin.

May 16: Condition the same. Ice locally and to spine. Blood examination for leukæmia is negative.

May 17: Condition unchanged.

May 18: Wassermann reaction is negative.

June 16: Condition has remained unchanged. Patient is dis-

Fifty per cent of the transitory erections reported in the literature were due to an ascending peripheral stimulation as the result of irritation from some disease or abnormality of the external genitals (urethritis, 12 cases, 100 cases reported by Hill not included, stricture, 1 case, chancroid, 1 case, herpes genitalis, 1 case, venereal warts, 1 case, polyp in posterior urethra, 3 cases, varicocele, 1 case)

Nine cases occurred in the early stages of tabes dorsalis. Six had some psychic cause. Three were the result of irritation of the brain or cord centre from infectious toxins, the erection recurring and subsiding with the rise and fall of the temperature. One case was the result of cantharides.

Priapism Due to Nervous Causes—There were 35 cases that may be attributed to nervous causes.¹ Only three of these cases were the result of ascending peripheral stimulation, and these were all of only a few days' duration (venereal warts and phimosis, 1 anal fissure and phimosis, 1, polyp in fossa navicularis, 1). The remaining 32 cases were the result of descending impulses, 17 from the brain and 15 from the spinal cord. The 17 cerebral cases were both direct and indirect. Priapism resulted in one case from a tumor in the cerebellum. Another followed a rifle ball injury of the cerebrum, while a third was reported in an infant as a result of forceps injury to the head at the time of delivery. One case was indefinitely associated with epilepsy. Four cases were due to intoxications, three following cantharides and one accompanying diabetes. One case only was definitely associated with cerebrospinal syphilis. Five cases were associated with nasal polyp, the removal of the polyp being followed by an immediate cure except in one case in which thrombosis had evidently occurred to prolong the condition. These nasal cases have a peculiar interest in view of the observations of Mackenzie² and Fliess³ on the

¹ Since writing this paper Shropshire and Watterston have reported (*Southern Med J*, 1914, vii, 320) a case of priapism treated by salvarsan, intravenously, 4 weeks after onset, with gradual subsidence within the next few days. Wassermann test was negative, but leutin test was positive. It is possible, in view of the long duration, that this case was mechanical in origin and the subsidence a coincidence and not the result of antisyphilitic treatment.

² Mackenzie, J. N. "Irritation of the Sexual Apparatus as an Etiological Factor in the Production of Nasal Disease." *A G Med Sc*, April, 1884. "The Physiological and Pathological Relations between the Nose and the Sexual Apparatus of Man." *J Hôp H Bull*, 1898, ix, 10.

³ Fliess, W. "Die Beziehungen zwischen Nasr und Weiblichen Geschlechtsorganen in ihrer biologischen Bedeutung dargestellt." *Leipz u Wien*, 1897, F. Denticke, 245 j, 8°.

PRIAPISM

assumed to have nerve fibres which may carry impulses to the erectile centre in the lumbar cord.

An erection represents a remarkable circulatory phenomenon of increased venous pressure. This increase in pressure is effected in two ways, by an augmented inflow and by a diminished outflow. The erectile tissues contain large venous spaces, freely anastomosing and in communication with their arterial supply without the intervention of any definite capillary system, and it is the marked overdistension of these spaces that produces the rigidity of the organ. The arterioles to these areas have both vasoconstrictor and vasodilator nerve fibres. The vasoconstrictors have been shown to arise (dog) from the second to the fifth lumbar nerves, to pass over to the sympathetic chain and thence to reach the penis either by way of the sacral sympathetic ganglia and their branches to the pudic nerves, or by way of the hypogastric nerve and pelvic plexus. The vasodilator fibres arise from the sacral cord (first to third, dog), pass by way of the nervi erigens to the pelvic plexus, and thence to the penis. Stimulation of the nervi erigens has been shown (dog) to produce a large dilatation of the arterioles in the erectile tissues, and augments the flow of blood to the part eight to fifteen times.

To this increased inflow in an erection is opposed a partial occlusion of the venous outflow. The efferent veins of the corpora cavernosa pass by way of each crus through the ischiocavernosus muscle, and that of the corpus spongiosum by way of the bulb through the bulbocavernosus muscle. The dorsal vein of the penis is the efferent outlet for the glans and has no constricting muscle other than intrinsic ones. These muscles are supplied by the pudic nerves and their contraction completes the act of erection by compression of these efferent veins which they surround, the occlusion not being complete, but enough to greatly increase the venous pressure in the erectile tissues. In addition to these special muscles there are smooth muscle fibres freely distributed throughout the spongy tissues of the penis, action of which, no doubt, has an intrinsic value in increasing venous pressure. It is seen, therefore, that erection is a complex nervous and circulatory phenomenon.

Classification of Priapism.—There have been several attempts to subdivide cases of priapism. The most complete and recent analysis was presented by Sheuer in 1911, who grouped his cases into those due to local causes and those to general diseases. The local causes he subdivided into:

makes an interesting observation in reporting a case of priapism accompanying a complete motor and sensory paralysis up to the level of the third intercostal space, in which it was found that the erection could be made to disappear by pressing the penis down, but that as soon as left in this relaxed position it could be seen to distend with each pulsation. Beck attributed the condition to paralysis of the vasomotor nerve fibres supplying the vessels of the penis. Loss of cerebral control may also result in the escape of impulses from the erectile centre to the muscles, which by their contraction would produce a circulatory obstruction and a partial erection. Howell states that no report has been made of erection occurring experimentally as a result of section of the vasoconstrictor fibres to the penis, as would be expected if the above observation and conclusion of Beck were correct. It is more likely that the cerebral inhibition produces both vaso-dilatation and muscle spasm in somewhat the same way as occurs normally in the case of nocturnal erections in sleep.

Priapism Due to Mechanical Causes—There were 135 cases which had a mechanical or a combined nervous and mechanical element as a cause for the priapism. Thrombosis of the veins of the corpora was by far the most common factor, and can be assumed to have occurred in 125 of the cases. Sixty-four of the cases, in 55 of which there was thrombosis, followed sexual excess. In three of these there was a nervous factor, in that they had frequent short intermittent erections preceding the onset of the thrombosis and the priapism. In six cases the thrombosis accompanied a general infection (appendicitis, yellow fever, malaria, tuberculosis), and occurred as the result of a local cavernitis in ten and a local abscess formation in one case. Two cases were due to local luetic angioneurosis. In two other cases the obstruction was due to local new growths of the penis (sarcoma and carcinoma). Local injury produced hæmatoma or thrombosis of the venous spaces of the corpora with subsequent priapism in seven cases. There were 28 cases in which the priapism had been preceded by recurrent transient attacks of erection. The priapism, however, is really due to the mechanical factor, although it doubtless would not have occurred if the nervous element had not been present. Of these 28 cases, there were 2 tabetics, 5 neurotics, 3 with intoxication from cantharides, 3 with intoxication from some general infection and 15 with some local disease (urethritis, etc.), in all of which transitory recurrent erections preceded the final continuous and prolonged attack evidently due to a thrombosis.

Priapism occurred in association with leukæmia and gout in about

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The nervous causes may be simply subdivided into these:

(a) From ascending peripheral stimuli (reflex).

(b) From direct stimuli: (1) to the spinal cord centre; (2) to the nervi erigens or pudens.

(c) From descending cerebral stimuli: (1) direct; (2) indirect.

The mechanical causes may be subdivided into:

(a) Thrombosis, or pseudothrombosis.

(b) Hemorrhage and hæmatoma.

(c) New growths of the penis.

(d) Inflammatory swellings and œdema of the penis.

Analysis of Cases.—The meagre and poor histories in many of the reports render an attempt to arrange the cases according to the above classification additionally difficult. Nevertheless, the result, although inaccurate in part, is instructive and interesting.

Transitory Erections.—Erections of short duration are relatively common with all inflammatory conditions of the lower genito-urinary tract, and sometimes accompany certain diseased conditions of the nervous system. They are pathologic in the sense that they are painful and without sexual desire; but their frequent occurrence, short duration and tendency to recur, strongly distinguishes them from the uncommon, remarkable condition of prolonged and persistent erection. For this reason, the cases of recurrent or nocturnal erections of transitory reflex nature, about 43 cases reported in the literature as priapism, are not included as cases of true priapism. Many cases of priapism, however, are preceded by these transitory erections and, therefore, such cases are of importance as a factor of predisposition to the rarer and more serious condition. They may be of two kinds:

I. Local reflex forms of erections (acute transitory erections) which occur commonly with any abnormal condition of the lower genito-urinary tract, and which clear up permanently with relief of this local trouble. These forms are of small significance.

II. Painful erections, usually nocturnal and of short duration (chronic transitory erections), but of such frequent recurrence and over such a long period as to greatly interfere with sleep and with the pursuit of the patient's occupation. These transitory erections are mostly nervous in origin, as in tabes, sexual neurasthenia, etc. They may be so frequent and troublesome as to seriously impair the health of the individual. There are cases on record of recurring attacks of erection, of a few minutes' or hours' duration, lasting for 10 to 12 years, during which time every method resorted to failed to give relief. Curiously enough, these cases usually occur in men past middle age.

primary inciting cause and the mechanical factor the fundamental prolonging cause. The 45 cases occurring in the course of leukæmia are included here, although in most instances the condition may be well considered as purely mechanical in origin. Forty-five cases (30 per cent) were of primary mechanical origin, although no doubt transitory nervous reflexes complicated the condition in some of these cases. It will be seen that mechanical factors are not uncommon. One hundred and thirty-five, or 80 per cent, have a local mechanical cause, either alone or in combination with a nervous element as the important factor.

Symptomatology—There is no marked difference in the symptoms of the nervous and mechanical group of cases, except that over 80 per cent of the nervous cases, as compared with less than 10 per cent. of the others, had a duration of less than 10 days.

Age—Priapism may occur at any time of life, but is most frequent between the twentieth and fiftieth years (97 cases). There were 18 cases under twenty and 14 cases in men over fifty. The youngest case was in congenital syphilis and occurred shortly after birth. The oldest case was of nervous origin in a man of seventy-five (the age was not given in 40 cases).

Duration—Excluding cases of transitory erection of only a few hours' duration, priapism is seen to persist from two days to over two years. Over 65 per cent of the cases attributed to mechanical cause (thrombosis, etc.) lasted between 20 and 60 days. Eighty per cent of the leukæmia cases had a duration of this character. On the other hand 85 per cent of the nervous cases lasted less than 10 days (there was early death in 50 per cent of these cases). There was slow and gradual subsidence of the condition in only one case of the nervous group, while a rapid subsidence was stated as occurring in about 50 per cent of these cases. Of the mechanical group 70 per cent of the non-operated cases were said to have a slow and gradual recovery and in not one case was a speedy cure observed (the duration was not definitely given in 47 cases and the character of the subsidence was not stated in 65 cases).

Previous Attacks and Onset—Previous attacks of a few hours' duration were stated to have occurred in 34 cases, 27 of which are in the mechanical group. This emphasizes the significance of intermittent or short attacks as an etiologic factor in the prolonged condition, and the importance of careful treatment of persistent painful nocturnal erections which so commonly accompany disease of the genitals.

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interrelationship of the nose and the internal organs in women, and the external genitals in man. Fliess designates certain points in the nasal mucosa as "genital spots," which swell, bleed easily and are sensitive to the touch at the time of menstruation. These spots are located on the tuberculum septi and the anterior part of the inferior turbinate in either side of the nose. Mager⁴ found he could permanently cure 50 to 75 per cent. of his cases (93) of dysmenorrhœa by a few applications of trichloroacetic acid to these genital spots. Fliess and Mackenzie describe for the male analogous spots, pathogenic disturbance of which may set up a nasal reflex sexual neurosis, or *vice versa*, as considered by Mackenzie (being a laryngologist), the influence of pathology of the sexual apparatus is of importance in the production of nasal disease. The nerve path of this reflex is not known, but its existence would explain the pathogenesis of these five cases of priapism associated with nasal polypi, and suggests as well a therapeutic measure in certain cases of psychic priapism.

Fifteen cases of priapism were associated with injury or disease of the spinal cord. In one case in which the priapism had persisted for over a year, there was found at autopsy a general myelitis of the cord. In another case a new growth (sarcoma) was found pressing upon the cervical cord. The other 13 cases were the result of fracture, 11 being in the cervical region, 1 at the level of the third lumbar and another at the level of the second thoracic. In the fracture cases the priapism occurred at the time of the injury, and in most of the cases did not persist up to the time of death, but subsided spontaneously after a few days. It is of interest also that in several cases the erections were not complete. In five of the cases it is stated that complete erection would reflexly occur upon stimulating the glans. The ischiocavernosi were noted to be contracted and board-like in most of the cases. These cases are probably examples of loss of cerebral inhibition rather than due to cerebral stimulation.

In the discussion by Goetz, "Über Erektion und Ejakulation bei Erhängten" (About Erection and Ejaculation in the Hanged), no explanation is offered for the condition which is analogous to cases of priapism following injury of the cervical cord. In one case reported by Goetz, the man lived twenty-four hours after his neck was broken, and recovered consciousness. Ejaculation had occurred and erection persisted up to his death, although there was no sexual desire. Beck

⁴Mager: The Internal Treatment of Dysmenorrhœa. *J. Am. Med. Ass.*, 1914, lxii, 6.

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27 per cent. of the cases. This proportion is unexpected in view of the rarity of the condition in leukæmia. Cabot did not find a single case of priapism in his series of 89 cases of leukæmia and it has not occurred as a complication in any of the cases at the Johns Hopkins Hospital. Nevertheless, there are 45 cases that show a definite relationship to leukæmia. The pathogenesis is probably both nervous and mechanical in character. There is no evidence to indicate disease or direct irritation of the brain or spinal cord in these cases. However, it is possible that the condition of the blood tends to set up a reflex erection, which is then prolonged by a subsequent thrombosis. The evidence for thrombosis is convincing. Twenty-nine, about 70 per cent., had a duration of from twenty to sixty days. The corpora cavernosa were stated to be alone involved in 18 of the cases. Five cases were operated upon and thrombus found. The subsidence in the non-operated cases was slow, spontaneous and gradual. That the thrombosis is not the only factor is evidenced by the statement, in over 50 per cent. of the cases, of previous attacks of short duration, usually of the nature of nocturnal erections. The cases associated with tabes and those the result of an ascending peripheral reflex are similar to those with leukæmia in respect to a history of short previous attacks, or of bothersome nocturnal erections preceding the priapism. It is possible that the marked increase in white blood corpuscles brings about a distention or congestion in the vessels of the penis, which reflexly produces stimulation of the erectile centre and so causes these short, frequent, nocturnal erections. Many of the cases (stated in 14) had a sudden onset in the night, and thrombosis would be more apt to occur with the penis distended than when flaccid.

The four cases associated with gout are similar to the leukæmia cases and may be attributed to a thrombosis supervening upon a nervous reflex. They lasted from three to six weeks and all subsided slowly and spontaneously.

Nine cases in the literature are so incompletely reported as to be doubtful and are not classified.

SUMMARY OF ANALYSIS OF CASES

The above analysis of cases of true priapism shows that only about 20 per cent. are purely nervous in origin, and it is questionable whether a thrombosis had not occurred as the prolonging factor in some of these. Eighty cases (50 per cent.) were the result of both nervous and mechanical causes, the nervous factor being in most instances the

This supports the fact that the centres for erection and ejaculation are at a different level and are separate

Subsequent Power of Erections—Inability to have an erection after the subsidence of the priapism was observed in only 17 of the cases and, inasmuch as the time of observation in most of these had been for a few months at the longest, presumably all of them may have eventually recovered this function. A recovery of the ability to have an erection was mentioned in 36 of the histories. In several cases a slow or partial recovery was noted, it being a frequent observation that the early erections following priapism, and particularly when due to thrombosis with cavernitis, were crooked or that the distention was greater in one corpus than in the other. A recovery of the power to have normal erections was noted relatively much more frequently in the nervous group of cases than in the mechanical. The loss of the power of erection was not mentioned in a single nervous case but there were 17 deaths in this group.

Mortality—In not a single case was death attributable to the priapism. There were 33 deaths, 11 from leukæmia, 18 following cerebral or spinal cord injury, 2 from pyæmia, and 2 of doubtful cause. The erection persisted after death in 3 cases.

PATHOGENESIS

Priapism may follow or accompany a great variety of conditions. This protean character of its etiology has led to considerable confusion in establishing its pathogenesis. A normal erection is a complexity of nervous and circulatory factors. The circulatory factor is effective through a special anatomical arrangement of blood-vessels, whereby obstruction to circulation results in congestion of the venous spaces under arterial tension. In this sense a normal erection is mechanical. The pathologic condition is also always mechanical, but may be due to obstruction from nervous reflex spasm of the muscles partially occluding the efferent vessels as in a normal erection, or to obstruction to venous outflows from intrinsic cause, such as thrombosis or hæmatoma of the vessels.

There have been various theories advanced to explain priapism. Thrombosis has been considered as a factor in some cases, the remaining cases being attributed to complex nervous elements. Recently Worms and Hamont⁵ advance the idea of a diagonal passage of the

⁵ Worms, G., and Hamont, A. Sur le priapisme prolongé et son traitement. *Chirurgicale Gazette des Hôpitaux*, 1913, xlv, 709.

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The condition is not stated to have had a gradual onset in a single case. Sudden onset in the night is mentioned in 23 cases, 11 of which were in leukæmia. It followed coitus in 22 cases, of which 50 per cent. were after coitus interruptus, followed defecation in two leukæmia cases, and came on after an enema in one case. The onset was sudden in all of the cases (not stated in 56).

Character of the Erection.—This was stated in 63 of the histories and in 43 of these, 70 per cent., the corpora cavernosa alone were involved, the glans and spongiosum not taking part in the erection. Thirty-eight of these are in the mechanical group (18 in leukæmia). In the 5 other cases the priapism was the result of a fracture at the level of the cervical cord and it was noted in all these 5 cases that a complete erection would follow stimulation of the glans which would soon subside, leaving the corpora alone erect. In these 5 cases there was spasm of the ischiocavernosi. In 10 other nervous cases the whole penis is stated to be involved, while in only 10 of the mechanical cases was a complete erection observed to be present.

Pain.—The condition was not uniformly painful. In some cases there was little if any discomfort. In the great majority of the cases, however, there was pain present, particularly on handling. In a few cases this was extreme, particularly in those cases due to a nervous reflex.

Urination.—Urinary symptoms were mentioned in 73 of the cases. In 60 there was frequency, difficulty or retention. Several cases had to be catheterized. In only 13 is it stated that urination was undisturbed. These disturbances are associated in the great majority of the cases with a complete erection, *i.e.*, erection of the corpus spongiosum.

Sexual Desire.—There was loss of all sexual desire in 107 of the cases (not mentioned in 60 cases). In three cases in the nervous group there was at first an increase in sexual desire which was only temporary, as subsequently, except in the case of Donne in which death occurred early, there was loss of all desire.

Ejaculation.—This was not observed to have occurred at the onset of the priapism in any case except in those cases in which the condition followed coitus. Attempts were made in several cases to relieve the condition by coitus and in most cases a normal ejaculation occurred, but with an aggravation rather than a relief of the priapism. After the priapism had subsided and before a return of the power of erection attempts at coitus were followed in 11 cases by normal ejaculation.

The first stage in thrombus formation is the erection in a slowed blood stream of a morphological structure of blood platelets or leucocytes by a process of deposition and agglutination. In the second stage, coagulation occurs by the formation of fibrin ferment. These principles may be applied to the causation of priapism. There is a slowing of the blood stream with a widening and stretching of the vessels and formation of eddies. Blood platelets or leucocytes are deposited, and in case the factor of agglutinability is present, are cemented together, so as to plug the vessels. Later there may or may not be the liberation of fibrin and coagulation.

According to these ideas, transitory erections, probably, are all nervous in origin, but cases of true priapism may be either nervous or mechanical. The nervous cases are relatively few and are apparently due to a prolonged spasm of the ischiocavernosus muscles, or to a complex of nerve stimuli as in normal erection. The mechanical cases comprise the majority. They are almost invariably preceded by nervous causes. These incite an erection, which is prolonged by local obstruction by the formation in the stagnant, congested blood stream of either pseudothrombus or true thrombus. In a few cases mechanical obstruction is effected by the presence of a tumor, of a hæmatoma or a hæmatocele. No doubt even in these cases, however, there is also additional mechanical obstruction from pseudothrombosis, as is evidenced by the absence of unilateral or localized erections.

DIAGNOSIS

It is important for purposes of treatment that the four groups of pathologic erections be differentiated. The acute transitory reflex erections differ from chronic recurrent erections only in degree. Both are of short duration, are painful and are unaccompanied with sexual desire. The former are mostly associated with disease of the genito-urinary tract and disappear with improvement of the local condition. The latter are more often associated with some marked nervous disturbance, such as tabes or a marked psychosis, and are often extremely resistant to all medication and may persist for years. This chronic character renders the condition serious. Each group may occur during either the night or day, although the chronic group have erections more frequently during the waking hours. The transitory erections are complete in character, no case being on record of erection of the corpora cavernosa alone. They usually subside quickly if the patient awakes (when nocturnal) or after urination, or sometimes only after he gets up and walks about or does something to distract his mind.

They last from a few minutes to a few hours. The transitory reflex erections are significant only as a predisposing factor to priapism, but the chronic recurrent erections are, in addition, frequently of so serious a nature as to demand radical measures for their relief.

In true priapism it will be difficult to differentiate between a nervous and a mechanical cause. A blood examination should always be made, and if leukæmia exists, the case is most likely mechanical. If the patient has a brain or spinal cord injury, the priapism is as definitely nervous. The previous history is of importance with respect to attacks of transitory erections, which frequently precede a mechanical priapism. The nature of the onset, whether following sexual excess, coitus interruptus, or sudden onset in the night, is significant of a mechanical cause. If the case has persisted for more than six or seven days, it is more likely mechanical. In case the corpora cavernosa are alone involved and the ischiocavernosæ are not chronically contracted, the case is almost sure to be mechanical. The genito-urinary tract should be carefully examined. Priapism following local disease or injury is almost always mechanical. The cases cited by Hobbes suggest elimination of the possibility of some nasal disease which might incite a nervous priapism. The possibility of a cerebral or spinal cord lues should be eliminated. In the case of tabes there will have been previous nocturnal erections and the condition will be mechanical. The probabilities in the absence of a brain and spinal cord lesion are greatly in favor of a mechanical cause for the condition.

The condition of satyriasis should offer few difficulties. It may, however, be accompanied with a persistent erection, as in the case of Donne, and the condition may lead to thrombus formation and mechanical priapism.

TREATMENT

There has been no definite method of procedure in the treatment of priapism. Internal medication has no apparent effect. In many cases leeches were applied to the penis and perineum, with no result. Almost all the sedatives and hypnotics known to medicine have been tried and found futile, and even deep narcosis gives no relief. The condition has been treated by operation in 34 cases. In one case the dorsal arteries of the penis were ligated with a cure. In the other cases, incision of one or both corpora cavernosa was practised and with immediate benefit in all but two cases. In one (Dawson) the incision was apparently too superficial to relieve the obstruction, and the case gradually and spontaneously subsided after 11 days. The other case (Sothron) was of

nervous origin and persisted in spite of all medication, and even after incision of the corpora

The subdivision of the cases into four groups suggests the need of a different procedure in the treatment of each group

Treatment of Transient Erections—This will depend largely upon the etiological factor. In case the recurrent nocturnal erections are the result of an ascending peripheral stimulation from a urethritis, stricture, herpes genitalis, etc., satisfactory treatment of the local disease gives permanent relief. In case tabes is present, recurrent erections may not respond to any form of internal treatment, even antisyphilitic, and certain psychic forms of the condition are equally stubborn. Lewis cured one case of over two years' duration by ligation of both dorsal arteries of the penis. In case of repeated recurrences, in spite of sedatives and thorough local and general treatment, some operative measure along the same lines as for nervous priapism should be undertaken.

Treatment of Priapism of Nervous Pathogenesis—These cases should have thorough general treatment before subjecting them to operation. Eighty per cent have a duration of less than ten days, and furthermore the general condition of these cases, particularly those of brain or spinal cord injury, is so serious that the priapism is of minor and secondary importance. Those few cases, however, in which the priapism is the serious feature, and which persist for more than a week, should be relieved by operative means.

Several operations suggest themselves.

1 It would be possible to expose the pudic nerves in the perineum and inject their sheaths with some drug, or to divide them with a knife. The superior terminal division of the pudic nerve with the dorsal arteries penetrates the ischiocavernosus muscle on each side, and supplies this muscle as well as the vessels and intrinsic muscles of the corpora cavernosa and glans. Blocking of impulses carried by it would relieve the spasm of the erector muscles and the erection of the corpora.

2 The two dorsal arteries of the penis can be exposed close to the pubes and ligated, as was done by Lewis. This would prevent an increased blood flow to the corpora and relieve their erection.

3 The ischiocavernosus muscles themselves may be divided in the perineum, and the nerve and artery with them. To what extent the power to have future erections would be destroyed by any of these three procedures is problematical. Lewis does not mention this point in his case.

Treatment of Priapism of Mechanical Pathogenesis—There seems to be one simple and effective form of operation for this form of priapism, no matter what its particular etiology may be. This is by incision and drainage of either one or both corpora cavernosa. A single incision, inasmuch as the blood-vessels of the corpora anastomose freely, is about as effective as double incision. In the 33 cases in which this operation has been done, there was immediate cure in all but two cases (in one the incision was apparently not thorough enough, and the other in which the operation failed was one of nervous pathogenesis). Worms and Hamont have advised this operation for all forms of priapism, but it would seem to be applicable to the mechanical form only. The operation does not destroy the power of future erections. Priapism even may follow, as occurred in one case several months after the operation. These very favorable results recommend an early and thorough incision of one or both corpora cavernosa in all cases of mechanical priapism.

Technic of the Operation—Unfortunately few of the operators have indicated (no one clearly) the procedure followed by them in opening the corpora. The incision in a majority of the cases has been made a little back of the midpart of the corpus on the dorsolateral surface. The mid-dorsum and ventrum are to be avoided because of the dorsal vessels and nerves above and the urethra below. It seems important that this incision should extend well into the spongy tissue of the body and be of sufficient length to allow of the contents to be thoroughly evacuated. In many of the cases both corpora were opened, in some others only one incision was made on one side and the opposite corpus emptied through this (the vessels of the two anastomose). The fibrous sheath of the corpus should be completely slit and the incision extend deeply into the spongy tissue or the veins and spaces will be with difficulty and only partially emptied.

The contents are described as consisting of "black grumous blood," "thick clot," "thick coagulum," "coagulated blood," etc. No definite thrombus is mentioned nor described for any of the operative cases. Kast found at autopsy, in his case, "large leukæmic thrombi" in the corpora cavernosa. The corpora are only emptied after considerable squeezing and manipulation, and it has been necessary in some cases to make secondary incisions into the spongy tissue through the primary skin opening in order to completely empty the organ of its contents. In all cases the entire corpus seemed involved in the process. In no case was there excessive bleeding afterward. Usually a small wick or

- Bays, A H · On a Case of Persistent Priapism *Bristol Med-Chir. Jour*, 1883, 1, 224
- Beck, B Ueber Verletzungen der Wirbelsaule und des Reuckenmarks *Virchows Arch*, 1879, lxxv, 226
- Bernstein Ein Fall von Priapismus *Monatsberichte f Urol*, 1905, x, 12
- Betz, F Zerreiſung des Reuckenmarks und der Reuckenerven durch Hyperflexion des Koepers *Memorabilien*, 1873, xviii, 167, *Abstr Arch f Derm und Syph*, 1911, 109, 474
- Birkett A Case in which Persistent Priapism Was Caused by Extravasation of Blood into the Corpora Cavernosa of the Penis *Lancet*, February, 1867, 207
- Blanc, R Sur un Cas de Priapisme prolongé *Revue pratique des mal des organ gen-urin*, xxvii, V année
- Blanchard, R G A Case of Priapism *Atlan Med Weekly*, 1897, vii
- Blum, V A Case of Leukemic Priapism *Lancet*, London, 1906, 1, 1573
- Booth, M On a Case of Persistent Priapism *Lancet*, 1887, 978
- Bouveyron Priapisme chronique de sommeil *Lyon Med*, 1909, xxxiv, 313
- Brooks and Boswell A Case of Priapism *Steth and Virg Med Gaz Richmond*, 1851, 1, 558
- v Broich Ueber Priapismus *Arch f Derm und Syph*, 1904, lxx, 2
- Bruce Report of a Case of Priapism *Lancet*, 1873, 1, 90
- Bryant *International Encyclopedia of Surg*, vi, 660
- Burchard, F H A Case of Priapism of Three Years' Duration with Recovery. *New York Med Jour*, 1887, xlv, 66
- CH Idiopathic Priapism *Scots Mag*, 1755, *Abstr N Y Med Jour*, 1904, lxxx, 188
- Billaud A propos d'un cas de priapisme prolongé. *La Gazette medicale du Centre*, December, 1911, 274
- Calloway *London Medical Repository*, 1824, 286
- Carpenter The Treatment of Leucocythemia *Lancet*, London, 1880, 172
- Cabellero, F Un cas notable du Priapisme *Bol de Med Cirug y farm*, Madrid, 1851, 2, ep 1, 83
- Carroll, T Persistent Priapism with Report of a Case *Cincin Lancet-Clinic* n s, xxxv, 697
- Clark, F L G Recurring Attacks of Priapism *St. Thomas's Hospital Reports*, Lond, 1887, n s, xvi, 19
- Clary *Abstr Arch f Derm und Syph*, 1911, 109, 476
- Chinnock *London Med and Surg Jour*, 1836, 1-, 575
- Coskery, A J A Short Note on Priapism *Mary Med Jour*, Baltimore, 1881, 2, viii, 555
- Crago, W H A Case of Persistent Priapism *Auster Med Gaz*, Sidney, 1888, viii, 61
- Crancour, I L Persistent Priapism *New Orleans Med and Surg Jour*, 1880-1881, n s, vii, 330
- Dawson, J L Priapism, Its Causes and Treatment, Including the History of a Remarkable Case *Med News*, Phila, 1887, 1, 63
- Debrou, E Exam Physiologique du mecanisme de l'erection a propos d'une variete de priapisme qui ne se produit gue pendant le sommeil *Gaz Med*

- de Paris, 1850, 3, s, v, 698, 729 and 826 Ann de Med, Belge, Bruxelles, 297
- D'Haemont Observations d'un cas de Priapisme Progres Med Belge, 1899, 1, 3
- Delbet, P Gazette des hopitaux, 1908, 1203
- Deguire and Brascoe Observation d'un Priapisme Rec. Period Soc d de Paris, 1800, vii, 112
- Demeaux Priapisme spontane, persistance de l'erection pendant 30 retention d'urine, traitement energique, guerison Ann de la Chir f, Etang, Paris, 1841, iii, 403
- Demarquay Maladies Chir du Penis Deutsche Chir, 1, 242
- Doane, W H D Case of Injury of the Head with Rifle Ball with Priapism and Salacious Appetite West Med Gaz, Cincin, 1835, 11, 295
- Dietz, P Un cas de priapisme aigu Gaz Med de Liege, 1896, 7, ix, 198
- Dukeinan, W H A Case of Priapism of Several Years Duration P Med Jour of San Fran, 1889, vol xxvii, 480
- Dujon Deux Observations de priapisme prolongé Congres franc de Chir 1910, 1189, Le priapisme prolonge, en dehors des lésions nerveuses, pre operatoire par incision de l'une des racines des corps caverneux A franc de chir proc. verb, Paris, 1910, xxiii, 590, J Med de Brux, vol xvi, 181, Arch prov de Chir, Paris, 1910, xix, 638
- Dunn Lancet, August 1863, 162
- Dalle-Favera, G B Ueber einen Fall von Priapismus bei Leukaemie Monat f prakt Derm xlvii, 1
- Dyce Daleworth Edinb Med J, 1898
- Edes Cases of Leukemia Bost Med J, 1871, lxxv
- Eisenstaecker, M Ein Fall von Priapismus bei linealer Leukaemie W Med Woch, 1907, 15
- Emodi Funktionelle Stoerungen der Genitalien nach chronischer B l giftung Urologia, 1906 55
- Eschenbach, J Dissertationis de Satyriasi et Priapismo, 4 Jenae, 1670
- Fere, C P Priapisme epileptique Med Mod, Paris, 1898, ix, 73
- Fischer Ein Fall von 16 tage dauernden priapismus Zeitsch f Wundaertz Geburtsh Winnenden, 1880, xxvi, 19
- Fourmier "Lecons sur la periode precataxique du Tabes," p 53
- Frank, E R W Ueber die Beziehungen der papillomatoesen Wunderungen Blasenhalsses und der hinteren Harnroehre Zeitsch f Urol, 11, 1908, 922
- Friedmann Verh der Syph Gesellsch, Peters b, September 30, 1895
- Feurbringer "Die Stoerungen der Geschlechtsfunktionen des Mannes N agel, Spec Path und Therap, xix, 118
- Goebel Ueber idiopathischen protrahierten Priapismus Mitt aus den Granz, d Med und Chir, 1904, xvii
- Goebel, C Un cas de Priapisme idiopathique Egypte Med, Alexandria, 1, 1903, 11, 200
- Gore, A C Persistent Priapism even after Death Med Council, Phila, 19 vii, 406
- Goetz Ueber Erektion und Ejakulation bei Erhaengten Inaug Diss, Ber 1898

- Bays, A H · On a Case of Persistent Priapism *Bristol Med-Chir Jour*, 1883, 1, 224
- Beck, B Ueber Verletzungen der Wirbelsaule und des Reuckenmarks *Virchows Arch*, 1879, lxxv, 226
- Bernstein Ein Fall von Priapismus *Monatsberichte f Urol*, 1905, x, 12
- Betz, F Zerreiſung des Reuckenmarks und der Reuckennerven durch Hyperflexion des Koepers *Memorabilien*, 1873, xviii, 167, *Abstr Arch f Derm und Syph*, 1911, 109, 474.
- Birkett A Case in which Persistent Priapism Was Caused by Extravasation of Blood into the Corpora Cavernosa of the Penis *Lancet*, February, 1867, 207.
- Blanc, R Sur un Cas de Priapisme prolongé *Revue pratique des mal des organ gen-urin*, xxvii, V année
- Blanchard, R G A Case of Priapism *Atlan Med Weekly*, 1897, vii
- Blum, V A Case of Leukemic Priapism *Lancet*, London, 1906, 1, 1573
- Booth, M On a Case of Persistent Priapism *Lancet*, 1887, 978
- Bouveyron Priapisme chronique de sommeil *Lyon Med*, 1909, xxxiv, 313
- Brooks and Boswell A Case of Priapism *Steth and Virg Med Gaz Richmond*, 1851, 1, 558
- v Broich Ueber Priapismus *Arch f Derm und Syph*, 1904, lxx, 2
- Bruce Report of a Case of Priapism *Lancet*, 1873, 1, 90
- Bryant *International Encyclopedia of Surg*, vi, 660
- Burchard, F H A Case of Priapism of Three Years' Duration with Recovery. *New York Med Jour*, 1887, xlv, 66
- CH Idiopathic Priapism *Scots Mag*, 1755, *Abstr N Y Med Jour*, 1904, lxxx, 188
- Billaud A propos d'un cas de priapisme prolongé *La Gazette medicale du Centre*, December, 1911, 274
- Calloway *London Medical Repository*, 1824, 286
- Carpenter The Treatment of Leucocythemia *Lancet*, London, 1880, 172
- Cabellero, F Un cas notable du Priapisme *Bol de Med Cirug y farm*, Madrid, 1851, 2, ep 1, 83
- Carroll, T Persistent Priapism with Report of a Case *Cincin Lancet-Clinic n s*, xxxv, 697
- Clark, F L G Recurring Attacks of Priapism *St Thomas's Hospital Reports*, Lond, 1887, n s, xvi, 19
- Clary *Abstr Arch f Derm und Syph*, 1911, 109, 476
- Chinnock *London Med and Surg Jour*, 1836, 1-, 575
- Coskery, A J A Short Note on Priapism *Mary Med Jour*, Baltimore, 1881, 2, viii, 555
- Crago, W H A Case of Persistent Priapism *Auster Med Gaz*, Sidney, 1888, viii, 61
- Crancour, I L Persistent Priapism *New Orleans Med and Surg Jour*, 1880-1881, n s, vii, 330
- Dawson, J L Priapism, Its Causes and Treatment, Including the History of a Remarkable Case *Med News*, Phila, 1887, 1, 63
- Debrou, E Exam Physio'ogique du mecanisme de l'erection a propos d'une variete de priapisme qui ne se produit gue pendant le sommeil *Gaz Med*

- Klehmert: Berliner Klin. Woch, 1908, No. 18, 896
- Klemme Schmidt's Jahrbucher, 1886, cxxxi, 173.
- Kocher, Th Die Laesionen des Reuckenmarks bei Verletzungen der W
Isaeule Mitt aus den Grenz der Med und Chir, 1896, 1
- Koschel Ein Fall von Priapismus bei Leukaemie Berl Mihtaeraertzliche C
April 22, 1908; Abstr Berl Klin Woch, 1908, 18, 896
- Kunst, W. Leukaemisches Priapismus mit nervoesen Pathogenese Med κ
1907, iii, 45
- Lang, E. Fall von Priapismus Verhandl der k k Gesell Aertze in Wi
Wiener Klin Woch, 1896, No 45
- Laurent and Nove-Josserand Le Priapisme Gaz des hopitaux, 1908, 1203
- Lean, L. Priapismo Chronico Nocturno Jour Soc d Sc. Med de Lisb, 190
Ixx, 266
- Lewis, Brinsford Case of Semi-priapism, Ligation of the Dorsal F
Arteries, Recovery Med Fortnightly, St Louis, 1897, xii, 332
- Lloyd Med Times and Gaz, 1852, ii, 185
- Loewenfeld, L. Sexualleben u Nervenleiden, Wiesbaden, 1906, 274, 1
1011, 14
- Lohnstein, I Vorstellung eines Falles von Priapismus Berl Klin Woch, 1
Abn. 410, Ueber Priapismus. Verhandl d Berl Med Gess, 1907, xxxviii, 71
- Longuet M Priapisme chez un malade atteint de Leucaemie splenique Prog
Med, 1875, 447
- Luke Lancet, 1867, July 5
- de Lonjon Priapisme, Castration pratiques par le malade lui-meme Hemor
rhagie de l'artere spermatique emploi du perchloride de fer guerison Rec
de trav Soc Med d'Indre et Loire, Tours, 1854, 21
- Louyer-Villermay Priapisme Dict d Sc Med, Paris, 1820, xlv, 114.
- Mackie Edinbor Med Jour, 1872, 418
- Mainzer Idiopathischer Priapismus, 9 tage persistierend Deutsch Med Woch,
1903 No 41
- Manassese Lecons de Therapeutique generale Abstr Arch f Derm u Syph,
1911, No 102, 464
- Margulies, M Beitrage zur Frage des Priapismus Russki J Koschn in Ven
Bolesney, January, 1904, Agstr Monat f Harnkrank u Sex Hyg, 1904,
491.
- Markow Persistent Priapism N Y Med Jour, 1885
- Mathias Noch ein Fall von Priapismus bei Leukaemie linealis Allg Med
Zentralzeitg, 1876, No 97-8
- Mathieu. Neurasthenie et Hysterie combinees Progres Med, 1888, ii, 58
- Maurel Sur un priapisme suivi de retention d'urine Jour de Med Chir
Pharm, 1772, 150
- Maurer Inaug Diss, Halle, 1883
- Mori Un cas de priapisme permanent. Gaz degli ospedali el delle clin, 1905,
xxvi, 952
- Morris, H Cases of Induration of the Erectile Tissues of the Penis Lancet,
1895, September 14
- Moore, J A Singular Case of Priapism Amer Med Recorder, Phila, 1823,
vi, 94.

- Gohl, J D. De foedo priapismo in agonigante, colica spasmodica laborante, a me observato Selecta Med Francof Francof ad Viado, 1737-1739, 1, 116
- Gundegger, R I Sluchae Priapizma Bolnitsch Gaz, St Petersburg, 1, 1901, xii, 954
- Gross Western Med Gaz, Cincin, 1835, ii, 14
- Gunckel, P L Priapism a Symptom of Leukemia, Report of a Case Amer Med, Phila, 1906, xi, 27
- Guttman Ueber einen Fall von Leucaemia acutissima. Berl Klin Wochenschr, 1891, 48
- Gyabrenths Jour d Med Chir et Pharm, Brux, 1848, vii, 223
- Haillet and Viardin Priapisme et grosse rate, 25 jours d'erection continue, sans remission n'ayant cede qu'apress un debridement des corps caverneux Bull Med, 1904, 72
- Hargis Observations on Persistent Priapism with a Case Treated Successfully by Bromide of Potassium New Orls Jour of Med, 1869
- Harwood, E C Prolonged Priapism in Connection with a Localized Myelitis (1 year and 16 days) Inter Jour Surg, New York, 1889, 1, 7
- Hill, E A Case of Priapism Cured with Large Doses of Salophen Denver Med Times, 1899
- Hird Case of Priapism Lasting Six Weeks, Recovery Lancet, January, 1873, 90
- Hobbs, A G Priapism from Nasal Reflex, Something for the Rhinologists Indiana Med Jour, Indianop, 1906-1907, xlv, 142, Another Case of Priapism from Nasal Reflex Atlanta Jour-Record Med, 1906-1907, viii, 217
- Homberg, A De Lentigine, 8 Jenae, 1671
- Hughes, C H A Case of Persistent Eccentric Priapism Kansas Med Index, Fort Scott, 1880, 1, 198
- Heustis, J F Idiopathic Priapism New Orls Med and Surg Jour, 1858-1859, xv, 641
- Hulke A Case of Long Continued Priapism after Coitus, Remarks Lancet, December 8, 1888, 321
- Hunt, W On Priapism Accompanying Injuries of the Spine Phila Med News, February 8, 1882, xl, 281
- Jadioux Hypertrophie ancienne du foie et rate priapisme probablement du a l'administration des cantharides et suivi de mort Gaz des hopitaux, Paris, 1845, 626
- Janzion Observation sur une fièvre remittante maligne ou ataxique, ayant le priapisme pour principal symptome pendant le duree du redoublement Ann Soc. de Med Prat de Montpel, 1804, iv, 146
- Jewsejenko Priapismus durch eine Operation zur Heilung gebracht Wratsch, 1881, 11, Ref Petersburg Med Wochenschr, 1881, 39, 337
- Jones, Handfield Lancet, 1873
- Kast Ueber den Leukaemischen Priapismus Zeitschr f Klin Med, 1895, xxvii, 79
- Kauders Ueber Priapismus und Cavernitis Wiener Med Jaehrbuecher, 1882
- Kaufmann Verletzungen und Krankheiten des Penis Deutsche Chir, 1, 243
- Kethl Ein Fall von Priapismus bei Leukaemischen Orvosi Hetilap, 1883, No 9

- Klemme, A C J Ueber einen Fall von Leukaemie linealis Marburg, Cassel, 1863
- Neidhart Ueber Priapismus bei Leukaemie Allgem Med Zeitung, 1876, 682
- Neumann, J Ueber Priapismus und Kavernitis Med Jahreshb, Wien, 1882, 11, 143
- Niemann, A Ein Beitrag zur Behandlung der Erektionen beim Kinde Therap Monatsh, Ber, 1910, xxiv, 423
- Nickerson, L H A Case of Priapism Cured by Dilatation of the Urethra. Virg Med Weekly, Richmond, 1878, v 29
- Noth Priapism Accompanied by Deafness Ending in Death Indian Lancet, Calcutta, 1899, xiii, 437
- Nole, Leon Priapisme inflam constate chez un infant de douze et treize ans, inutilite des premiers moyens employes pour le combattre, et bons effets decivifs de la soignee generale Jour de Med Chir et Pharm de Toulouse, 1855, n s, vii, 267
- Nuckols, C H Congenital Syphilitic Priapism Louisville News, Cincin Clinic, 1876
- Ohmann-Dumesnil Case of Persistent Chordee Jour of Cut and Ven. Dis, N Y, 1885, iii, 177
- Oliver J H An Obstinate Case of Priapism South Med and Surg Jour, August, 1848, n s, iv, 592
- Peabody On Persistent Priapism not Connected With a Lesion of the Central Nervous System N Y Med Jour, 1888, xxxi, 463
- Petraens, H De Gonorrhœa, Satyriasi et Priapisme Ref Becker, Nosol harmonica dogmat et Hermat, 4 Morparigi Cattorum, 1616, ii, 361
- Payne Priapism and Impotence Virg Med Monthly, 1876, iii, 615
- Peyer Die Nervoesen Erkrankungen der Uro-Genital Organe Handb d Harn-u Sexualorgane von Zuelzer und Oeberlaender, iv, 226
- Pitres Ann d Mal des Org Gen Urin, 1901, 3
- Prasada, M Persistent Priapism for 47 days, probably due to Urethritis Indian Med Record, Calcutta, 1897, xiii, 283
- Pryce, H V Painful Persistent Priapism apart from any gross lesion of the Central Nervous System St Barth Hosp Reports, 1902, London, 1903, xxviii, 99
- Prallini, C F De priapismo ab extracto panchymagago Collu Misc Acad Nat. Curios Lips et Francof, 1694, i, decuria, 3, 240
- Raikline Le Priapisme chronique nocturne Annal des mal d org gen-urin, 1901, No 3, xix, 294, Kronicheskiy nochoi priapizm Klin Jour. Mosk, 1901
- Rathelot, A Une forme exceptionnelle de priapisme Farseille Med, 1894, xxxi, 177
- Richet Fall von spontanem Brande der kavernoesen Koerper des Penis Arch d mal de Paris, July, 1841
- Robert and Vidal Bons effets de l'emploi de lepulm contre les erections qui surviennent a la suite de l'operation du phimosis Bull gen de Therap, Paris, 1855, xlviii, 128
- Rokitansky Lehrb d Path Anat, 1885, iii, 407
- Rosenthal Anzeiger d K K. Ges d Aertze in Wien, 1882

PRIAPISM

efferent vessels through the sheath of the corpora cavernosa, which in congestion binds these vessels at this point so as to produce priapism. They consider all cases as due to this factor. However, if this were the explanation of the condition, one would expect priapism to occur much more frequently than it does, as this factor is present in all men. It is true that the anatomical structure and arrangement are at the bottom of priapism, but only in connection with other factors, which occur only occasionally. Our analysis shows that nervous causes for the condition are exceptional, and that most cases are apparently due to some form of obstruction, of which thrombosis is the most common. This is possibly not a true thrombosis in many cases, but the evidence in favor of the existence of at least pseudothrombosis is most convincing. In all the operative cases a definite thrombus, or thick, grumous or coagulated blood was evacuated. In the non-operative cases the condition subsided spontaneously and gradually, and in three cases the erection persisted after death. The frequent observation of erection of the corpora cavernosi alone also favors the theory of obstruction.

As is well known, there are a number of variable conditions closely related to the occurrence of thrombosis. There is no single cause. Its chief factors are generally held to be (1) slowing in the blood stream and the formation of eddies; (2) changes in the vessel wall itself, such as endothelial injury; (3) increased coagulability of the blood plasma; and (4) increased agglutinability of the blood elements. Aschoff⁶ believes that neither endothelial damage nor increased coagulability play any rôle in static and toxic capillary thrombosis, but that a slowing of the blood stream and an increased agglutinability of the blood platelets are the important factors, and that thrombus formation cannot occur without their coexistence, but that in static and similar types of thrombi, the slowing of the blood stream is of prime importance; whereas in the toxic varieties, changes in the blood elements play the greater rôle. Infection, according to Aschoff, plays a secondary part in the formation of thrombi, and when present usually supervenes upon an already existing simple thrombus. In the case of local infection (such as cavernitis of the penis) it might progress along the vessel wall and produce first a phlebitis, to be followed by a secondary thrombosis by deposition (phlebitis thrombosis—Aschoff).

⁶ Aschoff, L.: *Deutsche Naturforschers und Aertzte*, 1911; *Arch. Int. Med.*, 1913, xii, 503.

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- Vorster Zur operative Behandlung des Priapismus Deutsche Zeitschr f Chir, 1888, 173
- Walker Amer Med Jour, N Y, 1877, No 146, 565, April
- Ward A Case of Persistent Priapism Lancet, April 24, 1897, 1143
- Weber Persistent Priapism from Thrombosis of the Corpora Cavernosa Edinb Med Jour, September, 1898
- Weinerek, J Ein Fall von Priapismus durch Myeloid Leukaemie Beh Roentgenstrahlen Casopis lekaru ceskych v praze, 1907, xlv1, 571, Abstr, Scheuer, Arch f Derm u Syph, 1911, 109
- Weise Priapismus e causa arthritica Med Zeitschr v V f H in Pr, 1837, No 36
- Wetherell Persistent Priapism Med Record, N Y, 1880, xviii, 192
- v Windisch Priapismus, Schmidt's Jahrbucher, 1836, ix, 214
- Volkovich, M Sluchai Priapizma Trudo Kiyev, Khirurg Obsh (1908-9), 1910, 241-243.

PRIAPISM

They last from a few minutes to a few hours. The transitory reflex erections are significant only as a predisposing factor to priapism, but the chronic recurrent erections are, in addition, frequently of so serious a nature as to demand radical measures for their relief.

In true priapism it will be difficult to differentiate between a nervous and a mechanical cause. A blood examination should always be made, and if leukæmia exists, the case is most likely mechanical. If the patient has a brain or spinal cord injury, the priapism is as definitely nervous. The previous history is of importance with respect to attacks of transitory erections, which frequently precede a mechanical priapism. The nature of the onset, whether following sexual excess, coitus interruptus, or sudden onset in the night, is significant of a mechanical cause. If the case has persisted for more than six or seven days, it is more likely mechanical. In case the corpora cavernosa are alone involved and the ischiocavernosi are not chronically contracted, the case is almost sure to be mechanical. The genito-urinary tract should be carefully examined. Priapism following local disease or injury is almost always mechanical. The cases cited by Hobbes suggest elimination of the possibility of some nasal disease which might incite a nervous priapism. The possibility of a cerebral or spinal cord lues should be eliminated. In the case of tabes there will have been previous nocturnal erections and the condition will be mechanical. The probabilities in the absence of a brain and spinal cord lesion are greatly in favor of a mechanical cause for the condition.

The condition of satyriasis should offer few difficulties. It may, however, be accompanied with a persistent erection, as in the case of Donne, and the condition may lead to thrombus formation and mechanical priapism.

TREATMENT

There has been no definite method of procedure in the treatment of priapism. Internal medication has no apparent effect. In many cases leeches were applied to the penis and perineum, with no result. Almost all the sedatives and hypnotics known to medicine have been tried and found futile, and even deep narcosis gives no relief. The condition has been treated by operation in 34 cases. In one case the dorsal arteries of the penis were ligated with a cure. In the other cases, incision of one or both corpora cavernosa was practised and with immediate benefit in all but two cases. In one (Dawson) the incision was apparently too superficial to relieve the obstruction, and the case gradually and spontaneously subsided after 11 days. The other case (Sothron) was of

peritoneally intact The incision was carried upward to the umbilicus, in order to get sufficient exposure through the usually thick abdominal walls, the abdominal cavity being opened, a considerable quantity of urine and blood clots were mopped out The patient was then put in the Trendelenburg position and the abdominal contents packed off with pads, and a jagged transverse rent in the roof of the bladder, easily admitting three fingers, was found This being the extent of the injury as far as could be seen, immediate repair was undertaken, and the rent closed by three layers of catgut sutures, placed successively through mucous membrane, muscular and peritoneal coats

The abdominal cavity was then closed in the usual way, with a cigarette drain and a catheter retained in the bladder The patient sustained practically no shock from the operation and the post-operative course was uneventful, except for three days of uncomfortable abdominal distention and a slight fascial infection, due to faulty chromic gut The retention catheter was removed after eight days and the patient was catheterized for a period of three or four days, after which he was able to pass his urine easily He was out of bed on the fourteenth day, and at the time of making this report, the nineteenth day after operation, he seems perfectly well and strong

In referring to the literature it is of interest to note the fall of mortality of operations in intraperitoneal rupture of the bladder. From an analysis of 93 cases collected by Watson and Cunningham up to 1906, the mortality was 42.2 per cent According to Thomson-Walker, an analysis of 78 cases gave a mortality of 43.5 per cent, and when only the last six years were taken, the mortality fell to 20.5 per cent The earlier the operation is performed the better the prognosis The longest period of delay, when operation resulted in recovery, seems to be that of Quick, who reports a case in the *ANNALS OF SURGERY*, 1907, of a patient who was not operated upon until 254 hours, or almost 11 days, after injury

A factor in making the mortality higher than statistics would suggest is that probably a large number of single cases, which are operated upon and die, are never reported, as against the successful cases, which the surgeon takes pains to record

OPERATIVE TREATMENT OF ACUTE EPIDIDYMITIS*

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OUR attention has been called to the meagre statistics on the operative treatment for the relief of acute epididymitis, by an article recently published by Captain L. S. Eckels, Medical Corps, United States Army, and in reviewing the literature on the subject we find in the pioneer work of Dr. F. R. Hagner, of Washington, and Dr. L. Bazet, of San Francisco, a stimulus to report our observations after reviewing over 300 cases in Ancon Hospital since 1908, in which operative treatment gave most gratifying results.

Acute epididymitis has a sudden onset with occasional prodromal symptoms as pain along the cord of the affected side and at the internal ring, or pain in the sacrum, but the case is usually well developed and the pain in the epididymis severe when the patient first seeks treatment. The picture is characteristic with a swollen and exquisitely tender epididymis. However, in two cases of right-sided epididymitis accompanied by vomiting, the tenderness was so great along the right side of the abdomen that the possibility of a coexisting appendicitis could not be ignored.

The temperature on admission ranges from normal to 104° F and may be preceded by a chill and accompanied by severe prostration. Swelling comes on suddenly, the tail of the globus minor being first affected, and, with non-operative treatment, reaches its height in three or four days. An acute hydrocele develops in a small percentage of these cases, giving an additional indication for operative treatment. If hydrocele is not present the enlarged epididymis engulfs the testicle. The pain is severe and more intense when accompanied by an acute hydrocele. A prone position and support to the scrotum mitigate the pain. Without operation all pain usually subsides in two weeks, after which swelling gradually diminishes, often leaving a permanent nodule in the tail of the epididymis.

Epididymitis is usually due to gonorrhœa or septic infection of the urethra, and when the epididymitis begins the urethral discharge dimin-

* Read before the Canal Zone Medical Association, June 20, 1914

ishes or even ceases, to return again after the epididymitis subsides. The disease usually occurs after the second or third week of gonorrhœa and is estimated to be a complication in ten per cent of all cases of gonorrhœa, regardless of the method of treatment. However, instrumentation, forcible irrigation and alcoholism during the course of an acute gonorrhœa predispose to epididymitis, and one attack predisposes to subsequent attacks.

Usually only one side is involved. The infection extends along the vas deferens to the epididymis where the epithelial lining of the tubules is infiltrated with round cells and becomes mucoid and desquamated, often blocking the tubules and causing distention of the canals by retained secretions. Degeneration and glandular atrophy follow and hyperplasia of the fibrous stroma results, forming patches of functionless tissue.

Surely, then, we find in acute epididymitis a condition warranting early operative interference. The extent of damage to the tubules is lessened by operation, the relief of pain is immediate, and recovery is much more rapid and complete.

Various methods of operation have been followed in our series of cases with equally good results, the primary object being to make multiple small punctures in the epididymis which can be done with or without delivering the testicle. If hydrocele or abscess be present they are treated radically, but in uncomplicated acute epididymitis an incision so small that no sutures are required is quite sufficient through which to puncture the epididymis, and is followed by the same good results that obtain in all of our cases.

An operation that appeals to us is as follows. After shaving the parts thoroughly we use a 3 per cent alcoholic solution of iodine. External and parallel with the epididymis, make an incision into the tunica vaginalis. This incision should be large enough to deliver the testicle. Examine the epididymis and make multiple punctures with a blunt probe in that portion which is inflamed. Gently massage the part, wash with warm salt solution and return testicle to scrotum. Close the tunica with catgut and insert a narrow iodoform gauze drain. The external wound is closed with silkworm gut, using the subcuticular stitch—the drain passing out at the lower angle.

After operation we apply a sterile gauze dressing and a suspensory bandage is used to support the scrotum. On the second day the wound is inspected and the iodoform drain is removed. Daily dressings are not necessary. Usually on the fourth day the patients are up and allowed the freedom of the wards and porches. On the fifth day we

OPERATIVE TREATMENT OF ACUTE EPIDIDYMITIS

apply a 2 per cent alcoholic solution of iodine over the line of incision and remove the sutures if silkworm gut has been used. In the majority of cases patients return to duty on the sixth day

A great deal of interest has centred around the possibility of sterility following double epididymitis both in the operative and non-operative cases

Cunningham of Boston reports 6 cases in which he operated bilaterally. Two of these patients have had children since the operation, two showed living spermatozoa in the semen, and the remaining two showed no spermatozoa in specimens obtained by massaging the vesicles. Our records show a number of bilateral epididymotomies without, however, observations as to sterility. One case in which we operated recently is of interest

Patient, Hospital No 162091, was admitted to Ancon Hospital, May 19 1914, with a history of gonorrhœa of one month's duration and "swelling in right testicle" which began 10 days before admission. On examination a slight purulent urethral discharge was observed, an acute epididymitis on the right side, and a temperature of 102° F. On May 20, under general anesthesia, the globus minor of the right epididymis was exposed through a small incision in the right side of the scrotum and several small punctures were made into the epididymis. A small iodoform drain was inserted and the incision closed with a single catgut suture. The pain was relieved at once and the temperature fell to normal in 48 hours and remained so until one week later (May 28), when an acute epididymitis developed on the left side. In 12 hours the temperature rose from normal to 101° F and the epididymis was so exquisitely tender that it could scarcely be palpated without causing excruciating pain. Two hours later a small incision was made under ethyl chloride anæsthesia through which the flattened end of a silver probe was inserted and the epididymis punctured. A few hours after operation the patient volunteered the statement that, although he had suffered severely during the night preceding the operation, pain was relieved immediately after the epididymis was punctured. The temperature fell to normal in 12 hours. Condom specimens of semen were examined 2 weeks after operation and motile spermatozoa were found. The urethral discharge returned after operation and patient remained in hospital for gonorrhœal treatment.

Success depends on operation. We should not persist in using non-operative measures when the patient's consent to operation can be obtained. The results are appreciated immediately by surgeon and patient. All symptoms disappear rapidly, and the patient is usually free from pain when he recovers from the anæsthetic. The temperature rapidly falls to normal and the pulse becomes normal. In over 300 cases in this clinic the average duration of temperature after operation was 36 hours. In one of our cases the temperature fell from

ford's hydronephrosis were transitory conditions associated with marked atrophy. Rayer avoids the association of complete obstruction and hydrorenal distention. Keen and Morris maintain that complete sudden obstruction brings about a rapid atrophy following a transitory distention. With this we agree. Experimentally both of a dog's ureters were stripped and one was ligated firmly at the ureterovesical junction. The animal lived for five days in a drowsy indolent state. At autopsy both kidneys were found hydronephrotic, the ligated ureter-kidney twice the size of the nonligated ureter-kidney. The measurements were as follows:

Right kidney	P M	A M *	Left kidney	P M	A M *
	cm	cm		cm	cm
Length	90	6	Length	70	6
Breadth	60	4	Breadth	50	4
Thickness	... 40	2	Thickness	30	2

TABLE I

EFFECT OF STRIPPING URETER COMPARED WITH EFFECT OF STRIPPING AND LIGATING URETER

Experimental Surgical Laboratory, N Y U 1913-14
Hydronephrosis

Dog No	Gross Findings †	Microscopical Findings	Cause of Death	Days of Life
146	Left Hydronephrosis, slight Right Hydronephrosis, slight	Diffuse glomerular and intertubular congestion Local congestion, parenchymula degeneration	Hydronephrosis	5

Obstructive inflammation of the urinary tract may be acute or chronic. Delbet⁸ and others report ulcerative pyelitis or ureteritis following calculus irritation. Oertel¹⁰ reports a singular inflammatory change in the kidney pelvis analogous to the connective-tissue hyperplasia in productive senile arteritis which permits distention under normal conditions of intrapelvic pressure.

Morris² reports many interesting anomalies of the ureter and the renal arteries obstructing urine delivery to the point of renal distention. Van der Bogert⁶ reports a congenital type of hydronephrosis following aplasia of the ureter.

* Estimate measurements

† "Left" and "right" refer to animal and are reversely represented in table and in Fig 8. Congestion is more marked in ligated ureter-kidney and degeneration has begun.

HYDRONEPHROSIS

AN EXPERIMENTAL STUDY*

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IN the course of a study of the causative factors of renal infection, the association of paralysis of the ureter and dilatation of the kidney pelvis and calyces was so frequent as to suggest experimental observations on hydronephrosis. The latter lesion may be defined as dilatation of the pelvis of the kidney by fluid attended by secondary dilatation and final obliteration of the calyces and by mechanical compression and atrophy of the parenchyma.

Clinicians⁷ explain the etiology of hydronephrosis in assuming mechanical obstruction to the outflow of urine by foreign bodies, neoplasms, inflammatory exudates, and the like.

Wagner,⁸ of Leipzig, describes the possible effects of traumatism to kidney and ureter. That traumatism gives rise to ureteral stricture or to peri-ureteral extravasation which may obstruct urine outflow and distend the kidney, he certainly affirms, that the intra-ureteral hemorrhage may coagulate and cause obstruction he faintly suggests. Ureters have been traumatized by ligation. They have been tied off experimentally as well as unwittingly. Experimentally "Guyon¹¹ and Albarran found congested kidney" after 57-70 hours of urethral ligation expressed by him in the following measurements:

Right kidney	P. M.	A. M.	Left kidney	P. M.	A. M.
	cm	cm		cm	cm.
Length .	5.5	5.0	Length	5.8	5.5
Breadth .	3.3	2.7	Breadth . .	4.0	2.8
Thickness	3.3	2.7	Thickness	4.0	2.9

Bradford⁹ ligated the ureter for 11-40 days. He found the ureter always completely obstructed and the kidney invariably distended so that on incision at second operation 50-70 c c of urine was liberated. Most frequently, hydronephrosis resulted, in three cases out of twelve, pyonephrosis followed. Both Guyon's "congested kidney" and Brad-

* Conducted at Laboratory of Experimental Surgery at New York University Medical School.

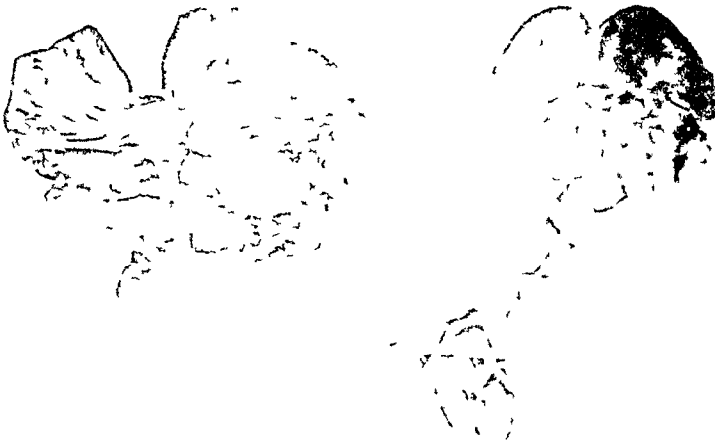


FIG 7 —Dog No 60 Pyonephrosis following secondarily infected hydronephrosis after stripping of ureter terminal stage Other kidney and ureter normal

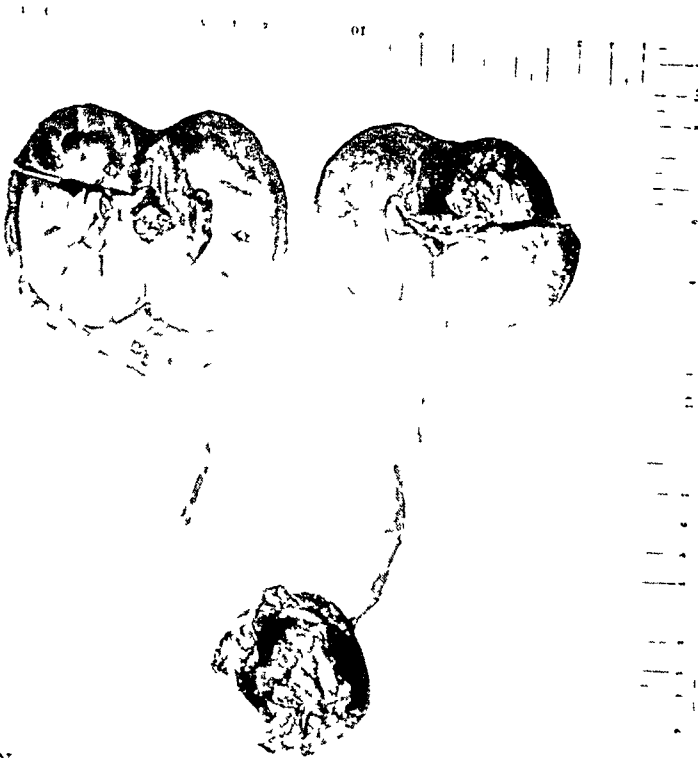


FIG 8 —Dog No 146 Hydronephrosis both sides produced on right by stripping of ureter and on left by ligation of ureter congested stages Notice perinephritic hemorrhage on left side

FIG 9 — Doy No 151 Hydroureter following stripping of ureter and circumcision of ureter. Other kidney and ureter normal



FIG 10 — Doy No 152 Hydroureter following ureteral calculus at junction of lower and middle thirds. Bladder shows vesical calculus



FIG 7—Dog No 69 Pyonephrosis following secondarily infected hydronephrosis after stripping of ureter, terminal stage Other kidney and ureter normal

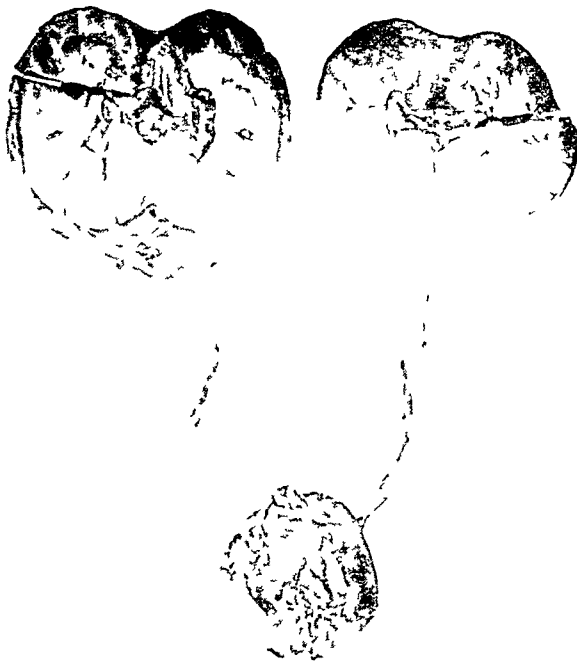


FIG 8—Dog No 146 Hydronephrosis both sides produced on right by stripping of ureter and on left by ligation of ureter congested stages Notice perinephritic hemorrhage on left side

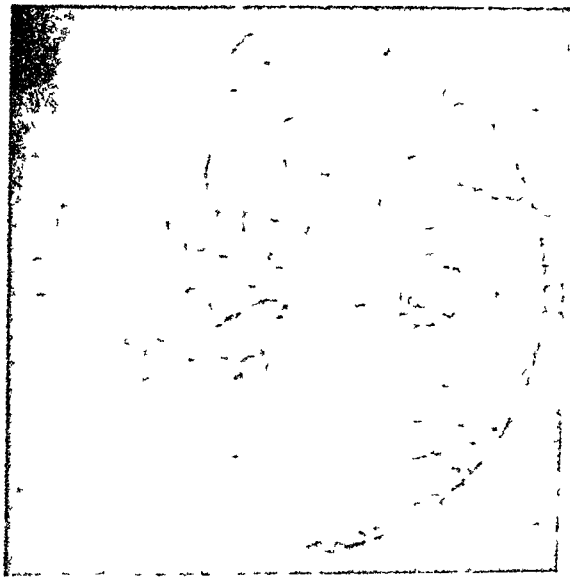


FIG. 10.—Distal tip of ureter showing tubular congestion occurring at the distal tip of a ureter.

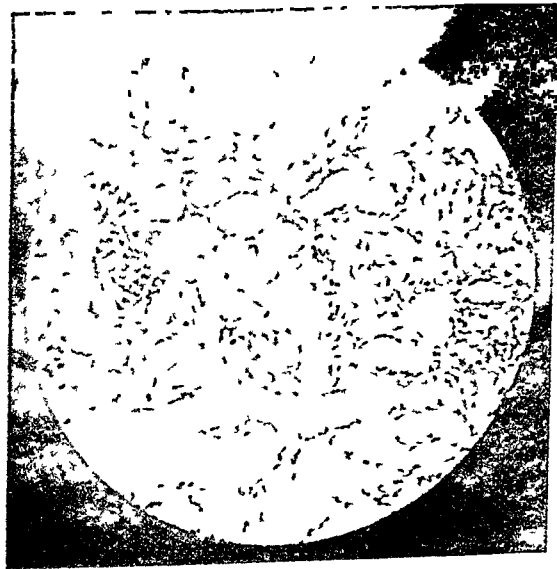


FIG. 11.—Distal tip of ureter showing dilated peripheral tubules from dilated tubules stage experimental hydronephrosis.



FIG 11—Hydronephrosis following calculus at ureteropelvic junction of ureter From clinical case

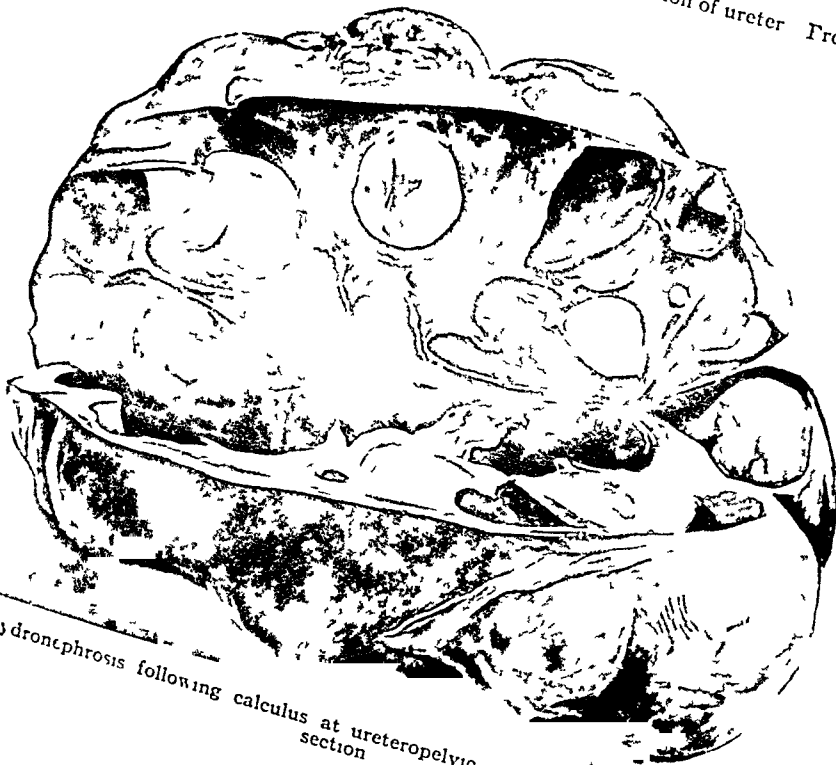


FIG 12—Hydronephrosis following calculus at ureteropelvic junction of ureter Showing cut section

PRIAPISM

- Rosenthal, F.: Ueber postappendizitischen priapismus. Berlin. Klin. Wochenschr., 1910, No. 4, xlvii, 147-149.
- Salzer: Ein Fall von langdaurendem Priapismus nebst Bemerkungen ueber die Beziehungen desselben zur Leukaemie. Berl. Klin. Woch., 1879, ii, 152.
- Scholz: Ueber Infiltration der Schwellkoerper des maennlichen Glieder. Wiener Klin. Woch., 1858, viii, No. 48.
- Schulze: Ueber Leukaemie. Deutsches Arch. f. Klin. Med., vol. lii.
- Scheuer, Oscar: Ueber Priapismus. Arch. f. Derm. u. Syph., 1911, 109, 449.
- Sick, C.: Ueber einen fall von sogenanntem idiopathischen Priapismus, geheilt durch inzision d. Corp. Carv. Vereinsblatt, der Pfaelzischen Aertze., November, 1905, xxi.
- Smith, Johnson: A Case of Priapism Lasting More Than Four Weeks; Recovery. Lancet, 1873, 804.
- Smith, J. R.: Idiopathic Priapism with a Case. New Orls. Jour. of Med., January, 1869.
- Scott, W. J.: Report of a Case of Persistent Priapism. Bull. Cleveland Gen. Hosp., 1899, i, No. 4, 23.
- Sothoran: A Unique Case of Priapism. Virg. Med. Semi-monthly, Richmond, 1902-1903, vii, 437.
- Soresina: Zwei Faelle von akuter Blen. mit Priapismus. Gior. ital. d. mal. ven. e. d. pelle., 1869, 3; ref., Arch. f. Derm. u. Syph., 1869, i, 603.
- Stichter, H. D.: A Case of Priapism of Spinal Origin. Therap. Gaz., Detroit, 1903, 3-s, xix, 532.
- Stanjeck: Ueber priapismus bei Leukæmie. Inaug. Diss., Leipzig, 1909.
- Steele, B.: Gunshot Wound of the Second Cervical Vertebra. Phila. Med. and Surg. Reports, xl, 11, March 15, 1879.
- Steuber: Ein klin. Beitrage zur Lehre von der Leukæmie. Inaug. Diss., Berlin, 1889.
- Stevens: A Case of Acute Lymphatic Leukæmia. Lancet, 1905, p. 153.
- Sticker: Beitrage zur Pathologie und Therapie der Leukaemie. Zeitsch. f. Klin. Med. 8, 188, xiv, 80.
- Stimson: Persistent Priapism. N. Y. Med. Jour., 1885, xli, 676.
- Tarnoksky: Die krankhaften Erscheinungen des Geschlechtssinnes. Berlin, 1886.
- Tauszky, R.: Ein Fall von Priapismus; 36 stunden nach dem tode beobachtet im Path. Inst. In. Wien. Wiener Klin. Pr., 1874, 713.
- Taylor: A Case of Prolonged Priapism. Maryl. Med. Jour., Baltimore, 1883, 4, x, 854. Causes of Priapism. Med. Record, 1899.
- Terrier, T., and Dujarier, C.: Du priapisme prolonge. Revue de Chir., 1907, 35.
- Thaut: Eulenburg's Realenzyklop.
- Thornburn: A Case of Priapism. Lond. Med. Gaz., April 17, 1830.
- Torday: Ein Flai von Priapismus. Orvosi Hetilap., 1906, 540; ref. Kollmann-Jacoby Jahresb., 1906, 308.
- Tripe, J. W.: Lancet, 1845, 8; Bull. of Med. Sc., 1845, iii, 032.
- Van Meter, S. D.: Priapism, Incision into Corpora Cavernosa. Tr. Colorado Med. Soc., Denver, 1902, 372; Intern. Jour. of Surg., N. Y., 1903, xvi, 147.
- Velpeau: Priapisme traite avec succes par la ponction du corps caverneux. Bull. gen. de Therap., 1852, xliii, 324.

To study the physiological effect of such traumatism upon the ureter a dog was etherized to analgesia and the following observations made upon ureteral movements

Case 160—(1) Waves of ureteral peristalsis were noted at 9-second intervals. (2) Waves of ureteral peristalsis were noted at 16-second intervals with middle ureter stripped. (3) Waves of ureteral peristalsis were noted at 25-second intervals with greater part of ureter stripped. (4) Waves not continuous. Fibrillary contractions noted at 69-second intervals with ureter completely stripped. While at the same time waves of peristalsis were observed at 7-second intervals in normal ureter.

Case 161—See case similarly treated. Two ureters were exposed—one left intact, other stripped. On rolling normal ureter under finger contractions were elicited; on rolling stripped ureter under finger no contractions could be aroused.

From this observation it would appear that a cause of urinary stasis in the above experiments was ureteral paralysis. We, therefore, further extended, and subject to further experimental proof as a cause of hydronephrosis, a ureteral condition analogous to adynamic ileus. In several of the cases a mechanically obstructed ureter was found, but that such obstruction was irrelevant appears from a comparison of ten subsequent cases in which not one similarly obstructed ureter was found. There were cases in which the valve was cut, and, in addition, the ureter was stripped.

TABLE III

HYDRONEPHROSIS PRODUCED BY STRIPPING URETER AND CUTTING URETEROVESICAL VALVE¹⁸

Case	Remarks	Microscopical Findings	Cause of Death	Days of Life
161	Normal	Normal	Hæmoperitoneum	0
162	Stripped middle ureter	Glomerular congestion	Hæmoperitoneum	2
163	Stripped middle ureter	Suppurative nephritis, abscesses, suppurative ureteritis	Pylonephritis	7
164	Stripped middle ureter	Congested parenchymatous swelling	Pylonephritis	3
165	Stripped middle ureter	Suppurative nephritis	Pylonephritis(?)	23
166	Stripped middle ureter	Parenchymatous degeneration, congestion	Pylonephritis	20
167	Stripped middle ureter	Suppurative nephritis, abscesses, tubules distended with pus cells	Pylonephritis	11
168	Stripped middle ureter	Glomeruli free	Pylonephritis	13
169	Stripped middle ureter	Glomerular congestion	Ether	18
170	Stripped middle ureter	Glomerular congestion	Ether	121

Histologically, the various changes in the kidney in experimental hydronephrosis have not yet been studied in sufficient detail to warrant more than passing mention at the present moment. The first step, however, appears to consist of widespread intertubular and glomerular congestion followed by granular degeneration and hydropic changes in

RUPTURE OF THE BLADDER*

REPORT OF AN UNUSUAL CASE

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THIS case of intraperitoneal rupture of the bladder seems sufficiently interesting to report, for the following reasons: First, that the case was not operated upon until 24 hours after the rupture; second, that the rupture of an apparently healthy bladder occurred without any sign or history of direct injury to the organ.

The patient, a male, forty-five years old, of medium height, weighing 194 pounds, was brought into Bellevue Hospital on the afternoon of April 22, suffering from severe abdominal pain, with inability to pass his urine. His past history was negative as to the present condition; his habits were those of a periodic alcoholic.

At ten o'clock in the evening, when called to the hospital, I was told that on admission late in the afternoon the patient was catheterized and 20 ounces of bloody urine were recovered. The temperature at that time was 99°, pulse 100, respirations 22. As there was nothing to arouse anxiety and as his real condition was not suspected, he was allowed to remain undisturbed until the evening, when he was again catheterized. This time 8 ounces of bloody urine were recovered and 4 ounces of boric acid solution injected into the bladder, of which only 2 ounces returned.

On physical examination I found the patient with flexed thighs; with a large pendulous abdomen, rigid and tender to pressure over its lower and anterior aspect, with no sign of traumatism, no tenderness in the renal regions; the abdominal walls so thick that percussion was almost of negative value, though there seemed to exist some dulness of the flanks.

The patient's general condition was good, with no sign of shock. He said that on the previous evening after a day of heavy drinking, he had slipped and fallen down four or five steps in a sitting posture. He was immediately nauseated and vomited the contents of his stomach. He then started to walk home, twenty blocks away, and though seized with severe abdominal pain, he was able to reach his home, undress and go to bed. After a sleepless night, due to continued abdominal distress, he rose, dressed about noon and requested that an ambulance be sent for, and he reached the hospital as previously mentioned.

Without further urinary examination the patient was prepared for operation. The usual suprapubic exposure showed a bladder extra-

* Read before the American Association of Genito-Urinary Surgeons, May, 1914.

To study the physiological effect of such traumatism upon the ureter a dog was etherized to analgesia and the following observations made upon ureteral movements

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Case 161—Case was similarly treated Two ureters were exposed—one left intact, other stripped On rolling normal ureter under finger contractions were elicited, on rolling stripped ureter under finger no contractions could be aroused

From this observation it would appear that a cause of urinary stasis in the above experiments was ureteral paralysis We, therefore, offer tentatively, and subject to further experimental proof as a cause of hydronephrosis, a ureteral condition analogous to adynamic ileus It is true in several of the cases a mechanically obstructed ureter was found, but that such obstruction was irrelevant appears from a comparison of ten subsequent cases in which not one similarly obstructed ureter was found These were cases in which the valve was cut and in addition, the ureter was stripped

TABLE III
SHOWING EFFECT OF STRIPPING URETER AND CUTTING URETEROVESICAL VALVE¹⁸

Case No	Gross Findings	Microscopical Findings	Cause of Death	Days of Life
74	Normal	Normal	Hæmoperitoneum	0
80	Congested	Glomerular congestion	Hæmoperitoneum	2
72	Pyelonephritis	Suppurative nephritis, abscesses, suppurative ureteritis	Pyelonephritis	7
77	Pyelitis	Congested parenchymatous swelling	Pyelonephritis	3
73	Pyelonephritis	Suppurative nephritis	Pyelonephritis(?)	23
89	Congested kidney	Parenchymatous degeneration, congestion	Pyelonephritis	20
88	Parenchymatous degeneration	Suppurative nephritis, abscesses, tubules distended with pus cells		11
83	Pyelonephritis	Glomeruli free	Pyelonephritis	13
81	Pyelitis, congested kidney	Glomerular congestion		18
84	Chronic nephritis		Ether	121

Histologically, the various changes in the kidney in experimental hydronephrosis have not yet been studied in sufficient detail to warrant more than passing mention at the present moment The first step, however, appears to consist of widespread intertubular and glomerular congestion followed by granular degeneration and hydropic changes in

4 The pathological changes in hydronephrosis of functional origin correspond to the age of the adynamic ureter

REFERENCES

- ^{1,2} Delafield and Prudden Text Book of Pathology, ed viii, p 722
- ³ Morris Surg Dis of the Kidney and Ureter, vol 1, p 395
- ⁴ Rayer Maladie des Weins, p 476, vol iii
- ⁵ Bradford "Observations Made Upon Dogs to Determine Whether Obstruction of the Ureter Would Cause Atrophy of the Kidney" Brit Med Journal, 1897, p 1720
- ⁶ Van der Bogert "Hydronephrosis with Aplasia of the Ureter." Arch Pedia, N Y, 1912, xxix, 764
- ⁷ Chetwood Hydronephrosis Its Etiology, Diagnosis and Treatment." Am Med, Burlington, Vt, and N Y, 1912, N P, vii, 97-104
- ⁸ Delbet "Hydronephrose partielle contribution à la pathologie des Hydronephrose" Ass franc d'ural Proc-verb Par, 1911, xiv, 462-468
- ⁹ Wagner "Die Traumatische Hydronephrose" Folia Urolog, Seipz, 1911-1912, vi, 697-753
- ¹⁰ Oertel "Chr Certain Changes in the Elastic Tissue of the Pelvis of the Kidney and their Relation to Hydronephrosis" Am Journal Med Sc, Phila and N Y, 1912, cxlvi, 398-402
- ¹¹ Guyon et Albarran "Physiologie Pathologique des Retentions Renales" Ass franc d'ural Proc-verb, 1897, Par, 1898, ii, 11-31.
- ¹² Hydronephrose consecutive à une pyelite chronique avec oblitération partielle du bassin et obliteration totale de l'ureter Jules Boeckel (de Shasbourg) Ass franc d'ural Proc-verb, 1897, Par, 1898, ii, 31-33
- ¹³ Cheput Arch Gen de Med, January, 1894, p 5
- ¹⁴ Zuerbelle "Ueber Veranderungen und Untergang der Glomeruli bei Hydronephrose" Frankfort, Ztschr f Path, Wiesb, 1912, x, 42-59, 3 pl
- ¹⁵ Draper and Braasch The Function of the Ureterovesical Valve Reprint from A M A, presented at Atlantic City, 1912
- ¹⁶ Keen The Text Book of Surgery, vol iv, pp 219-222
- ¹⁷ Lucas Physiological and Pharmacological Studies of the Ureter III A M J Physiology, vol 22, July 1, 1908, No 2
- ¹⁸ Barber and Draper Renal Infection A Further Experimental Study of Its Relation to Impaired Ureteric Function

HYDRONEPHROSIS

Keen¹⁶ and others enumerate tumors of the ureter and bladder among the causes of nephrectasia.

We offer for consideration the following: Physiologic or adynamic ureteral obstruction may give rise to distended kidney. To determine this we used dogs, after properly narcotizing with morphia and anæsthetizing with ether. In nine cases¹⁸ the ureter was removed from its bed and stripped of every recognizable vessel nerve and fascial connection from kidney pelvis to bladder insertion, and in order to make sure it was absolutely freed from nervovascular connections through its course as well as to irritate the suppositional nerve plexus in the adventitia of the ureter, this organ was rubbed snugly with dry gauze throughout. It was then allowed to drop back into the abdominal cavity. In each case a cubical foreign body infected with autogenous colon bacilli and other organisms, and of such shape as not to cause valvular urethral obstruction as suggested by Draper and Braasch, was placed in the bladder through a mesoventrad incision, so that, as subsequent examinations of urine and bladder revealed, a permanent purulent cystitis was produced. The results were as follows:

TABLE II
SHOWING EFFECT OF STRIPPING URETER¹⁸

Case No.	Gross Findings	Microscopical Findings	Cause of Death	Condition of Ureter	Bacteriological Findings	Days of Life
103	Hydronephrosis	Congestion	Intussusception	Patent	Coccus colon-like organ	7
70	Hydronephrosis	Dilated tubules	Hydronephrosis	Stenosed	Coccus colon-like organ	21
17	Hydronephrosis	Dilated tubules	Hydronephrosis	Patent	Coccus colon-like organ. No change in fixation test for colon	31
54	Hydronephrosis; hydro-ureter	Nephritis	Hydronephrosis	Patent	Culture omitted	25
69	Pyonephrosis	Purulent nephritis	Pyonephrosis	Stenosed	Coccus colon-like organism	29
21	Normal	Glomerular congestion	Perforation of bladder	Patent	No change in fixation test for colon	24
22	Parenchymatous degeneration	Parenchymatous degeneration	Peritonitis (technical)	Patent	No change in fixation test for colon	8
24	Interstitial nephritis	Productive nephritis	Pneumonia	Patent	Culture omitted	121
100	Hydronephrosis	Nephritis	Hydronephrosis	Stenosed	Culture	69

In each of the three cases designated "stenosed" the obstruction appeared to be organized blood within the ureter. Wagner, referring to his clinical case, alluded to intra-ureteral hemorrhage following traumatism. Blood is allowed to remain, coagulate, and be organized because of ureteral paralysis and is, in our opinion, coincidental rather than causative in the development of hydronephrosis.

nephroma, solitary kidney, hydro-ureter, localization of renal stone, and in exclusion for tumor differentiation

To this list we wish to add its use in traumatic injury of the kidney, and we believe it to be a means whereby positive information can be arrived at and determine how much laceration has occurred to the kidney substance, whether it is an intracapsular injury or whether the capsule has been torn through by the dissemination of the collargol within the kidney substance or outside of it. Conclusions can be arrived at, then, whether surgical interference will be imperative without waiting for the above-mentioned secondary symptoms as an indication for such interference.

After active bleeding has ceased the bladder is thoroughly washed out and the cystoscope introduced. An idea of the functional activity of the kidney can be ascertained by the use of indigo carmine or phenosulphthalein intravenously, then the ureter of the injured side is catheterized and a 15 per cent sterile solution of collargol very carefully and without undue force is introduced. Even while injecting the collargol, an idea may be gained, given a normal kidney pelvis, whether a great deal of laceration of kidney substance has occurred or if the capsule is torn through, this being determined by the amount of fluid that can be injected without giving the patient pain, it being a safe presumption that if more than 20-25 c c of collargol is used, that either there is great pulpification of the kidney substance or that the capsule is ruptured, thereby allowing dissemination into the perirenal space.

The character of the pain of which the patient may complain when sufficient fluid has been injected is not the characteristic colicky pain of an overdistended renal pelvis but a dull pressure pain referred to the lumbar region which occurs after considerable fluid has invaded the perirenal space.

Even before pain has been elicited back pressure upon the piston of the syringe gives the caution that the perirenal space which has been dissected up by the blood poured out following the injury is sufficiently distended.

The radiograph then taken will show either dissemination of the collargol within the kidney substance as in Fig 3, or outside and in the perirenal space as shown in Figs 1 and 2.

The first two cases here reported were admitted to the surgical service of Dr W H Lockett at the Harlem Hospital with a history of injury sustained to the kidney, and acting upon his suggestion this method was used to determine of what aid, if any, it will be in the diagnosis of injury to the kidney.

HYDRONEPHROSIS

the epithelium, particularly of the convoluted tubules. At a later stage, corresponding to moderately advanced dilatation of the pelvis, the cortical tubules become markedly distended, their lining epithelium undergoes atrophy and the interstitial tissues begin to show the effects of compression. Finally, with increasing dilatation of the pelvis and obliteration of the calyces, the kidney tissue becomes noticeably compressed and its individual elements—tubules and glomeruli—atrophy. In secondarily infected organs the mucosa of the pelvis is replaced by a thick membrane made up of degenerated polynuclear leucocytes.

Clinically, one of the recent cases occurring in the practice of one of the authors (Stewart) typifies the hydronephrosis complex and emphasizes the important relationship existing between experimental and applied surgery. In this case there were found at operation a large hydronephrotic kidney and a calculus snugly wedged into the ureteropelvic isthmus of the cephalad ureter. Through the courtesy of Professor Douglas Symmers, to whom we are indebted for the microscopical study of our specimens, it was determined beyond reasonable doubt that the specimen was an adult kidney which had undergone pressure atrophy from the extreme distention of the pelvis and calyces. Experimentally a similar case was produced in one of our dogs, dog No. 152, by a calculus accidentally slipped into the caudad ureter to the junction of the lower and middle thirds. But these cases, alike in their gross and microscopical pathology, corresponded with the specimens produced by paralyzing the ureters. There may be a relationship between the ureteral calculus and the prostatic wave that is in its effect the same as an atonic ureter. Especially does such a possibility seem likely when as in our human case the calculus intervened between the pelvic and straight portions of the ureter, the point where, as described by Lucas¹⁷ and observed by us, a change occurs in ureteral contractions and functions.

CONCLUSIONS

1. It is generally agreed that mechanical obstruction gives rise to urinary stasis and, when continued sufficiently long, to kidney distention.
2. This mechanical obstruction may be complete or incomplete, gradual or sudden. When the obstruction is sudden and complete transitory hydronephrosis with marked congestion follows. Atrophy intervenes and is proportionate to the duration of the obstruction.
3. Paralysis of the ureter is accompanied by urinary stasis and kidney distention in 66 per cent. of cases.



FIG 3 —M C aged eleven Showing dissemination of collargol in parenchyma

PYELOGRAPHY IN THE DIAGNOSIS OF TRAUMATIC INJURY OF THE KIDNEY

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THE symptoms present in traumatic injury of the kidney are more or less pronounced shock, pain in the lumbar region, particularly in the costovertebral angle, often radiating downward along the course of the ureters to the bladder, and genitals, hæmaturia of varying degree, rigidity and in severe cases temporary anuria on the side of the injury. If large amount of extrarenal hemorrhage, tumor mass in region of the kidney. Renal colic with cylindrical blood casts of the ureter are significant. Again there may be no bleeding if the ureter be torn across or if the laceration involves merely the fatty or fibrous capsule without crushing the kidney substance. While these symptoms determine definitely that the kidney has been traumatized, it does not tell us the amount or degree or character of the injury present.

Tuffier recognizes four degrees of injury. The first degree is characterized by subcapsular ecchymoses. When the violence has been more marked intrarenal blood extravasations are found most marked and constant at the base of the pyramids. In the third degree the capsule is ruptured; there is extrarenal hemorrhage, and deep, multiple stellate fissures of the kidney substance are produced, most pronounced about the hilum; sometimes they completely divide the kidney. Finally the organ may be reduced to a pulpy detritus.

Immediate operative interference is indicated only when signs of severe bleeding into the perirenal tissues, caused by rupture of the renal vessels, is present, or if the peritoneum is ruptured with severe bleeding into the peritoneal cavity; later, when symptoms of fever, tumor formation, increase of pain and high leucocyte count point to extravasation of urine into the perirenal space with infection and absorption therefrom.

Pyelography has been a valuable diagnostic aid in some of the surgical diseases of the kidney, as, for instance, hydronephrosis, pelvic dilatation from either ureter kink or nephroptosis, pelvic kidney, hyper-

ference is 3.8 cm. There is much folding, and the wall is, comparatively speaking, decidedly thin. The ureter passes obliquely through the bladder wall in the usual manner, and one is struck by its minuteness at this point, compared to the size of the structure elsewhere, because it can be penetrated only with a probe.

The right kidney shows fetal markings rather more pronounced than does the left. On the anterior and outer surfaces of the lower half of the organ, there are thirteen retention cysts, which vary in size from a pin head to 4 mm in diameter. On the posterior surface at the junction of the middle and upper thirds, there is another small cyst which measures 6 mm in diameter. The organ is 6.5 cm in length, 2.8 cm in width, and 2.6 cm thick. The pelvis on this side is very similar in appearance to the one on the left, but is not proportionately so large. It measures 3.6 cm from the kidney substance to the outermost portion of its circumference. It is 3 cm in width. This organ, as does its fellow, bears a very close resemblance to a cap placed over a membranous sac which is the dilated pelvis.

On section the kidney cortex is found to vary in thickness from 1 mm to 9 mm. The greater thickness at some portions is due to the fact that several prominent fetal lobulations are cut through. The entire anatomical arrangement of the organ is distorted, as in the left, the pyramids being entirely obliterated and an occasional depression marking the site of a previous calyx, a shell of kidney tissue of varying thickness is the impression one gets in examining the organ. On the outside of the thin pelvis are seen the veins and arteries coursing to the kidney proper. The greatest diameter of the inside of the urine-containing cavity is 4.7 cm. The beginning of the ureter is marked by a constriction and a slight folding of the mucosa. This measures 1.2 cm in circumference, and is the smallest portion of the ureter above the bladder. On this side the ureter is much smaller, particularly in its upper half, where it averages 2 cm in circumference. It becomes larger lower down, and at one point reaches a circumference of 3 cm. It is somewhat longer and more tortuous than its fellow, being 14 cm in length. It shows the same extraordinary reduction in size as it enters the bladder.

Blood Supply—Right kidney. An artery about 2 mm in diameter is given off from the lateral surface of the aorta. It passes upward and backward, and before reaching the dilated kidney pelvis it gives off a branch which divides into three smaller ones and supplies a part of the upper pole of the kidney itself. The main trunk passes to the dilated the kidney substance and the pelvis, giving off branches to both, and finally enters the kidney substance at about midway between the two poles. The larger branch passes anteriorly and, dividing into several smaller branches, becomes lost in the substance of the upper pole. A second artery, similar in size, comes off the aorta 7 mm below the one just described. It passes almost horizontally outward, attaches itself to the anterior surface of the pelvis, and gives off two larger branches and a smaller branch outward which give off branches to the itself.



FIG. 1.—Normal bladder and kidneys of 14 months old boy (three-fourths natural size)

four minutes in the urine from both sides, thus showing the injured remaining three-quarters of the right kidney to be normally functioning

CASE III—M C, age eleven, admitted to the Sydenham Hospital, January 7, 1914, under care of Dr Friedman

History—While crossing the street was thrown down by a wagon, sustaining an injury to the back and sides

Physical Examination—Great tenderness in the left upper quadrant of abdomen and back, involving the left kidney region Bloody urine Temperature range during her stay at the hospital was 101° , the highest on the second day, and was normal on the fifth day Leucocyte count on January 6 was 12,000

Patient cystoscoped under anæsthesia by Dr Friedman Indigo carmine injected intravenously came through on both sides within three minutes The left kidney then injected with 25 c c of 15 per cent collargol and radiographed by Dr Unger Operation not indicated and patient left the hospital January 15 Urine was clear, feeling perfectly well

X-ray also showed fracture of the eleventh rib, which did not give any subjective symptoms



PRISON

Fig. 1 - Same as Fig. 2, except that the ureters and kidney pelves are opened up and spread out, showing fold. There are probes in the ureters where they pass through the bladder wall. There is also a probe in the slit like opening through the point of obstruction.



FIG 2 —Anterior view of a case showing hydro ureter and hydronephrosis in a boy aged three and one half months (one half natural size)



FIG. 3—Same as Fig. 2, except that the ureters and kidney pelvis are opened up and spread out showing folds. There are probes in the ureters where they pass through the bladder wall. There is also a probe in the slit like opening through the point of obstruction.



FIG 4 —Posterior view showing the left suprarenal gland and the arrangement of blood-vessels
(one half natural size)

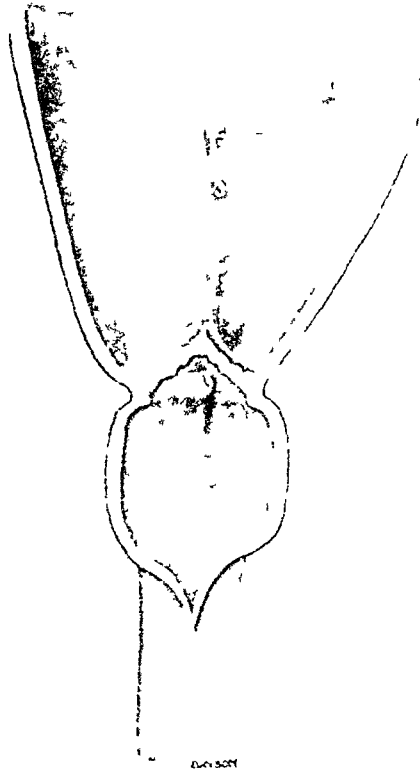


FIG. 1.—Diagram of posterior urethra. 1 lower end of internal (vesical) sphincter, 2 strands of tissue extending between trigonum vesicæ and upper end of verumontanum, 3 verumontanum, 4 lower end of verumontanum showing the obstruction, with a small slit like opening on the floor to the left of the middle line. The urethra is laid open and shows a dilatation above and below the point of obstruction.

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Veins accompanying this arterial supply, emptying into the ascending vena cava by four small trunks varying in size from 1 to 2 mm in diameter

Left kidney The upper posterior half of the left kidney is supplied by an artery 1.75 mm in diameter which arises from the lateral wall of the aorta about 3 mm below the uppermost renal artery on the opposite side. This vessel passes outward until it becomes attached to the pelvis of the kidney 6 mm from the kidney substance where it divides into two main branches, one of which passes down between the kidney substance and membranous pelvis, as far as the junction of the middle and lower thirds, and supplying both structures, the other passes directly to the upper pole where it subdivides and supplies this portion of the organ. A second larger artery, 2 mm in diameter, is given off 4 mm below, and considerably anterior to, the one just described. It passes outward to the pelvis and courses along its surface, finally dividing into branches which supply the anterior upper two-thirds of the kidney. A third artery, 1 mm in diameter, passes horizontally outward, becomes attached to the pelvis and, traversing it, finally divides into branches which supply the lower one-third of the organ.

The veins of this organ are interesting, in that the blood of the entire structure is collected in vessels which accompany this unusual arterial supply, and unlike those on the opposite side, the veins here join at the anterior upper portion of the pelvis and empty into the ascending vena cava in one large trunk 1.7 cm long after receiving a branch from the adrenal on this side.

The bladder seems to be about the usual size, but on section a most remarkable thickness of its walls is noted. This thickness is quite uniform over the entire organ and averages 8 mm. Throughout the entire fundus, there is noted a trabeculation with the formation of small cellules. The inter-ureteral ridge is present, but not marked, and the trigonum vesicæ is covered with a smooth mucosa, but is not particularly prominent. The ureteral orifices are slightly increased in size and their sphincters apparently obliterated. There is a ridge at the apex of the trigonum vesicæ which marks the site of the vesical sphincter. This latter structure is completely dilated so that the bladder and prostatic urethra are continuous and together form a funnel-shaped reservoir, the apex of which is found on a level with the apex of the prostate.

In the dilated posterior urethra are observed a number of prostatic duct openings. The verumontanum is peculiar in that six small bands are seen extending from the apex of the trigonum vesicæ to the largest portion of that structure where they seem to become imbedded in and form an integral part of it. At its widest portion, the verumontanum measures 3 mm. At this same point it is 3 mm in height. At its lowermost portion, a particularly interesting arrangement is noticed. Ordinarily the verumontanum, which is formed by the ingrowth of the Mullerian and Wolffian ducts and their accompanying muscular coats, as described previously by the author,¹ becomes smaller and smaller at its lower portion where its fibres, about 1 cm below its upper end in a specimen of this age, finally disappear by spreading out on the floor and

sides of the urethra in from 2 to 6 strands, some of which attach themselves to the walls. In this case some of the tissue of the verumontanum is disposed in the usual way, but a considerable portion of it continues down to the membranous urethra, where it divides into two portions and then attaches itself intimately to the entire urethral circumference with the exception of a very small slit-like opening on the floor of the urethra, just to the left of the median line which is lined with mucous membrane and could be penetrated with a fine probe.

The manner in which the division into two rather thick membranous bands occurs, and their attachment to the entire circumference of the urethra with the exception of a small aperture on the floor to the left of the median line, and also the fact that the entire structure is more or less dome-shaped, make the term "diaphragm," suggested by Dr Hugh H Young, seem most appropriate in referring to this anomaly. Almost complete obstruction to urinary outflow is caused by this unusual arrangement. Below the point of blocking, the bulbous urethra is considerably dilated.

There is a very large hydrocele of the right cord. Both testicles, the vasa deferentia, seminal vesicles, and the prostate are normal in appearance.

Microscopic Description—**Kidney** The section is a typical picture of compression of the kidney due to hydronephrosis. The kidney pelvis is surrounded by a thick wall of firm connective tissue in which are seen connective tissue cells with long, thin, darkly staining nuclei, whose long axes run parallel to the line of the fibres. Inside of this area there is a rather broad mesh-like layer of connective tissue in which there are large numbers of cellular fibroblasts and lymphocytes. There are also seen in this same area a great many eosinophile cells. The blood-vessels show rather thick walls, particularly the adventitial layers, and they are also congested. The straight tubules are atrophic and surrounded by connective tissue. The coiled tubules have disappeared in one portion of the section and are replaced by cellular connective tissue. Where they are present, their basement membranes are thickened by cellular growth. They show some cloudy swelling. The glomeruli are widely separated and greatly reduced in number. They show a rather thick capsule, and the glomerular coils have a marked increase in the number of endothelial cells. The interstitial connective tissue is everywhere increased and the picture has become, in the strict pathological sense, a chronic interstitial nephritis.

Ureter The wall of the thinned-out ureter is lined by transitional epithelium which is very markedly diminished in thickness compared with the normal. The mucosa is composed of squamous cells, arranged in two layers, which are attached to a basement membrane. The sub-mucosa seems to be thinned out in most places, and the muscular bundles are stretched out so that their long axis is in every case parallel with the axis of the ureter itself. There is a slight increase in connective tissue which is disposed between the stretched-out muscular elements, and there are many newly developed fibroblasts seen.

The bladder wall is tremendously thickened, and on microscopical

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examination it is observed that there is an increase in all the elements composing the structure. The muscle bundles are much increased in size, and not only do there seem to be a great many more than the usual number of muscle fibres in the bundles, but the fibres themselves appear to be larger than the ordinary smooth fibres of the bladder. The connective tissue elements are also greatly increased. The intramuscular connective tissue bundles are large, and scattered here and there very frequently throughout the muscular bundles at their borders are seen collections of recently developed fibroblasts in nests or groups. There is a very abundant blood supply. The mucous membrane is of the usual transitional type. It is thickened as is the submucosa.

Urethra. The dilated prostatic urethra is lined with epithelium of the transitional type, resting upon a felt-work of fibro-elastic bundles under which is a thickened submucosa. The verumontanum is interesting, in that, by the use of Van Gieson's stain, it is observed that while there is a sprinkling of muscular elements throughout, it is at its lower portion made up mostly of connective tissue fibres. It is quite vascular throughout its entire length, the vessels being rather more numerous and considerably larger than is usually the case. Cross-section at the point of obstruction shows a very small slit-like lumen lined with stratified epithelium, resting on a felt-like base under which is a very thick submucosa. Surrounding this there is an exceedingly extensive area rather densely arranged made up of connective tissue and smooth muscle fibres. There are a number of dilated vessels quite thickly scattered throughout this tissue.

Discussion.—The case here described is very similar to the one described by Knox and Sprunt,² but considerably more pronounced. These writers made a very exhaustive study of the literature up to the time their article appeared, and found that while no reports on the subject were recorded in the American literature, a great many almost identical cases had been described in foreign journals. Wilckens,³ Lederet,⁴ Tolmatschew,⁵ Bednar,⁶ Godart,⁷ Budd,⁸ Velpeau,⁹ Schlagenhauser,¹⁰ Commandeur,¹¹ Bonnet,¹² Teboul,¹³ Fuchs,¹⁴ Porak,¹⁵ Lindeman,¹⁶ and Picard¹⁷ being among the number who had written on this subject. Bazy¹⁸ observed six cases of congenital stricture in the region of the pars membranacea or pars bulbosa, in men and older boys, and emphasized the importance of congenital strictures even in adults. Ebert¹⁹ punctured the obstructing membrane in a similar clinical case and discharged his patient as cured. Englisch²⁰ collected a large number of cases of congenital narrowing of the male urethra.

Recently, JORDAN²¹ has published a case in which he found a stricture of the prostatic portion of the urethra in a boy about one year old, which measured one-quarter of an inch in length.

RIFORD²² has recently described nineteen cases of congenital stricture of the urethra that were treated in his clinic. Six of the nineteen died, a seventh

developed tuberculosis behind the narrowed portion of the urethra, but recovered. He considers it a relatively harmless developmental defect which only becomes serious when there is a considerable cutting off of the urethra, or when it is narrowed throughout its entire length. Dr Riedel classified his cases as follows:

- 1 Contraction of the urethra behind the membranous portion
- 2 Circumscribed area in front of the scrotum or an extensive network of stricture at the perineum
- 3 Stricture of the bulbous urethra
- 4 Stenosis in front of external orifice and in perineum

HENRY MORRIS²³ quotes a number of cases of congenital obstruction observed by himself and other European surgeons. Lamotte relieved a case, in which a thin membrane situated at the vesical orifice of the urethra had caused hydronephrosis, by passing a sound.

Howship (*Treatise on Diseases of Urinary Organs*) has described three cases of imperforate urethra and Dr Kennedy (*Dublin Journ Med Sciences*) exhibited to the Dublin Pathological Society the body of a new-born infant with enormous distention of the urinary organs, due to obstruction of the urethra. Dr Morris describes a case in which the kidneys, ureters and bladder were greatly distended, the only ascertainable cause being a small cyst in the mucous lining of the membranous urethra. This cyst did not quite fill the lumen of the urethra, but, being situated on the floor of the passage, it formed an effective barrier to the outflow of urine.

DR. HUGH H. YOUNG,²⁴ of Baltimore, has had several cases of congenital obstruction at the posterior urethra, two of which were similar to the case here described and both relieved by passing sounds. Another one was of a recent type, at the vesical orifice, and another a very peculiar double urethra, both of which he operated upon through the suprapubic route.

This case seems to be an anomaly of the development of the Wolffian and Mullerian ducts rather than a defect in the urethra itself. These structures, which in the male become the ejaculatory ducts, and the utriculus prostaticus, enter the prostate near its base and course in an oblique direction through that organ until they approach the urethra, at which point they turn and for a short distance run parallel with its axis, finally opening into its lumen. During their passage through the prostate, their musculature is bound together by a very definite, firm sheath of connective tissue. On their approach to the urethra, they push the floor of that structure up into a mound, forming the verumontanum, and still are separate from all other structures, their tissues being superimposed upon those of the urethra. Ordinarily, immediately below the openings of the ejaculatory ducts and utricle, the tissues surrounding them become distributed among the fibres on the floor of the urethra. Thus the verumontanum gradually becomes smaller and smaller until just below the apex of the prostate it disappears completely, spreading out laterally in the form of little bands which dis-

appear on the floor or walls of the urethra. In the specimen under consideration, although a number of fibres are disposed in the usual manner, the majority of them continue downward on the floor of the urethra. At the point where the verumontanum usually disappears, these fibres attach themselves to the entire circumference of the urethra, with the exception of a small portion of the floor to the left of the median line, thus producing an almost complete blocking of the urinary passage.

The dilatation of the urinary tract must have begun in this case as soon as any considerable amount of urine was secreted by the kidneys. On account of the obstruction to urinary outflow, the bladder undoubtedly filled up, and its continual contraction, in an attempt to empty itself, caused the enormous thickening of its wall and, by hydrostatic pressure of long standing, dilated the vesical sphincter to such an extent that it became absolutely ineffectual, a small ridge being left to mark its site. The posterior urethra thus became cone-shaped and directly continuous with the bladder lumen. The fact that the bladder wall has developed such an extensive hypertrophy instead of undergoing a thinning out process with separation of muscular bundles and enormous dilatation of the bladder lumen supports strongly the idea that the process has been very gradual and of long duration. By continually working against a gradually increasing pressure, the muscular fibres have become larger, more numerous and more compactly arranged so that the bladder lumen is only slightly if at all dilated. By the great thickening of its wall, the bladder has held the ureters in their passage through almost down to their normal size, although even under these conditions they are somewhat dilated in their course through the bladder wall and their sphincteric control has been totally or partially lost. The ureters and the pelves of the kidneys apparently do not respond by an extensive thickening, comparatively speaking, or at least if they do so, at first the increase in pressure overcomes such thickening, and these structures, being architecturally less competent than the bladder and prostatic urethra, become enormously dilated and the ureters are markedly lengthened so that in order to be accommodated they are thrown into distorted curves and folds. No particular reason can be found for the fact that the right ureter and kidney pelvis are somewhat smaller in size, and the ureter a little longer than the left. Back pressure has also distorted the arrangement of the kidney tissue proper, so that the usual landmarks are not distinguishable, and microscopically that organ shows a chronic interstitial nephritis.

In hydronephrosis, we have the remarkable picture of an organ

secreting fluid under a gradually increasing pressure, produced by itself, which finally brings about its own destruction

In children, a hypertrophied bladder wall with dilated ureters would seem to indicate a response on the part of the urinary tract to a gradually increasing obstruction of long standing, while a dilatation of the bladder, with thinning of its walls, is due to a more sudden and more complete obstruction to the urinary outflow.

It is rather difficult to explain why this particular anomaly should occur so frequently, as the point of obstruction in this and similar cases is above the junction of the pars membranacea and the pars bulbosa, which is the generally accepted ²⁵ point of division between that part of the urethra which develops from the entoderm and that which is derived from the ectoderm. Felix ²⁶ does not agree with the opinion expressed by Broman, but maintains that the entire urethra from the verumontanum outward is developed from the sinus urogenitalis and is of entodermal origin.

Undoubtedly, a great many of these cases have advanced to such a degree that there is very serious renal impairment at the time of birth, but since a number of them live for several years (Budd's patient was 16 years old, Lederer's 11 years, Wilcken's 2¼ years, Knox and Sprunt's case, 5 years), it seems most important to urge upon the medical profession that any children who show an urinary output below the normal, a dribbling of urine, abdominal masses in the kidney region, or other signs and symptoms pointing to a disturbance of the urinary organs, should have a thorough urethral exploration, and obstructions, such as the one here described, could be relieved by proper instrumental treatment.

This investigation was made in the Pathological Department of Bellevue Hospital.

The author expresses his most sincere thanks to Dr Charles Norris, Director of Laboratory, and his assistants, whose generosity and assistance have made its publication possible, and to Dr Hugh H Young for many helpful suggestions. The illustrations were made in the photographic studio at Bellevue Hospital by Dr Bryson, the Photographer to the Pathological Department.

BIBLIOGRAPHY

- ¹Lowsley *Am Jour Anat*, No 3, July, 1912
- ²Knox and Sprunt *American Journal of Diseases of Children*, September, 1912, vol 4, pp 137-147
- ³Wilckens *Zur Frage der Kongenitalen Stenosen der Mannlichen Hornrohre* *Ztschr f Urol*, 1910, iv, 814

MALFORMATION OF POSTERIOR URETHRA

- ⁴ Lederer · Ueber eine Angeborene membranöse Verengerung der Pars prostatica Urethrae Arch f. path Anat u Physiol, Berl., 1911, cciii, 240
- ⁵ Tolmatschew Ein Fall von Semilunaren Klappen der Mannlichen Hornrohre und Von Vergrosserter Vesicula Prostatica Arch f path Anat u Physiol Berl., 1870, xlix, 348
- ⁶ Bednar · Quoted from Wilckens,³ Lindeman,¹⁰ *et al*
- ⁷ Godart Valvule Anormale dans Le canal l'uretre Bull Soc Anat de Paris, 1854 xxix, 137
- ⁸ Budd Quoted from Wilckens,³ Lindeman,¹⁰ *et al*
- ⁹ Velpeau Traite d'anatomie Chirurgicale, Paris, 1826, ii, 297
- ¹⁰ Schlagenhauser Ein Beitrag zu den Angeborenen Klappenbildungen im Bereiche der Pars Prostatica urethrae Wien Klin Wchnschr, 1896, No 15, p 268
- ¹¹ Commandeur · Dilatation de l'Appareil urinaire Chez le foetus par retrécissement valvulaire Congenital de l'uretre Lyon Méd, 1898, Mars 13
- ¹² Bonnet Quoted from Wilckens³
- ¹³ Tchoul Quoted from Wilckens³
- ¹⁴ Fuchs Zwei Falle von Kongenitaler Hydronephrose Inaug Dis, Zurich, 1900
- ¹⁵ Porak Quoted from Commandeur¹¹ and Lederer⁴
- ¹⁶ Lindeman Casuistischer Beitrag Zur Frage der Angeborenen Klappenformigen Verengerung der Pars Prostatica Urethrae Inaug Dis, Jena, 1901
- ¹⁷ Picard Convulsions à forme eclamptique chez un homme Gaz méd de Strassburg, 1855, No 7, p 259 Quoted from Lindeman¹⁰
- ¹⁸ Bazy Rétrécissement Congenital de l' uretre chez l' homme Presse Méd, 1903, p 215
- ¹⁹ Ebert Quoted from Segall, Ein Fall von Angeborener Hornrohrenverengerung Inaug Dis, Königsberg, 1890
- ²⁰ Englisch Ueber Angeborene Verengerungen der Mannlichen Hornrohre Folia Urologica, 1909, iv and v
- ²¹ Jordan The Journal of The American Medical Association, July 26, 1913, vol 11, No 4
- ²² Riedel Archiv fur Klinische Chirurgie, June 17, 1913, pp 763-778
- ²³ Surgical Diseases of Kidney and Ureter, vol 1
- ²⁴ Young Personal communication
- ²⁵ Broman Normale und abnorme-Entwicklung des Meuschen Wiesbaden, 1911 (J F Bergmann), p 476
- ²⁶ Felix Die Entwicklung der Harn und Geschlechts Organe Handbuch der Entwicklungsgeschichte des Menschen (F. Keibel and F P Mall), ii, p 732

CIRCULATORY AND TROPHIC DISTURBANCES OF THE EXTREMITIES*

AN ATTEMPT AT CLASSIFICATION

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THE mixed nomenclature and the confusion that exists in the description of various conditions involving the extremities produced by vasomotor, circulatory and trophic conditions have prompted the writer to attempt to straighten out in his own mind the different diseases. The reading of the literature proved so interesting and revealed such a quantity of controversy and faulty tabulation, that it seems to the writer it would interest and instruct others were these diseases divided into distinct classes as complete entities. It is with an apology that he offers nothing new or original, either clinically or in pathology, but simply a tabulation of the work of others.

The rarest of the diseases under discussion is erythromelalgia. This condition was first described by Weir Mitchell in 1872¹ and in 1878² he first made use of the term erythromelalgia, which means *red, painful limb*.

The disease is of rare occurrence, only about 150 being reported in the literature, some of which should be eliminated as belonging to other groups of the confused types. Up to 1909 only 3 cases had been observed at the Johns Hopkins, and Osler at that time had seen but one case in private practice³. It has been the writer's fortune to see but one case, and that a typical one.

The disease affects men and women about equally, according to Fossier, and is most frequent between the ages of 20 and 40. The parts involved are usually one or both legs, although the arms may be the seat of trouble alone, or all four limbs may be involved.

The initial symptom is pain, confined to a more or less clearly defined area. This pain persists for several hours and then subsides, only to return at fairly regular intervals. The pain is of a burning character, described by the patients as "hot coals," and in the more advanced cases is of an intensity beyond description. Warmth of any kind, even the lightest covering, increases the severity of the pain.

* Read before the New York Surgical Society, May 13, 1914

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Prolonged applications of cold, either ice or ice-water, soothe the suffering. Pain may be the only symptom in the early stage, but later on in all cases and in some at the very onset, the other cardinal symptom appears.

This is the characteristic reddening of the limb, which manifests itself whenever the limb is pendent, and speedily subsides on elevating the part. The change in color is a bright red, sometimes mottled, with swelling but no œdema, increased surface temperature, acceleration of the arterial beats in the limb, and distinct engorgement of the vessels and capillaries. Cassirer⁴ divides the cases into two groups: 1. Where the pain and redness follow the distribution of some definite nerve trunk. 2. Where the entire distal portion of a limb is involved. Gangrene does not occur.

The pathology of this disease is most obscure, because none has been submitted to careful microscopic examination with conclusive findings. Lewin and Benda⁵ up to 1894 had collected all the cases, 41 in number. They do not believe that it is a disease *suu generis*, but occurs in various cerebral and spinal maladies, in neurasthenia, hysteria, and as a manifestation of neuralgia and neuritis or as a reflex disease. Weir Mitchell does not think this suffices, and believes it to be a *neuritis of nerve endings*. Cassirer considers it to be a peripheral neuritis, where the lesion corresponds to a definite nerve distribution, but where an entire portion of a limb is involved he considers that the disturbance is one of the vasomotor centres.

The course of the disease is undeterminable. It may progress to a certain point and there remain stationary, or it may advance so far that the sufferer is completely incapacitated, or again the symptoms may subside. The treatment is most unsatisfactory. Cold applications soothe the parts. Fossier reports two cures from the heavy injection of cacodylate of soda. Vasomotor constrictors are of no avail. About every drug in the pharmacopœia has been employed.

The symptoms and pathology of *intermittent claudication*, as a disease in horses, was well known to the French veterinarians several years before the disease was described by Charcot in 1859⁶.

The name, *intermittent claudication*, which merely means *intermittent lameness*, is a very poor one, for it is not sufficiently descriptive. The title *dysbasia angiosclerotica intermittens*, as suggested by Erb, is a better one, but custom and priority prompt us to retain the former.

The characteristic symptom of the disease is the *intermittent lameness*. It appears only on exertion and varies with the severity of the

disease After a short walk there is a gradual cramping of the muscles of the legs and feet, with increasing disability, which finally becomes so insistent that the patient must rest After a few minutes of repose the cramps and disability disappear, and the patient can resume his walk On renewing the exertion the cramps and disability return, requiring another period of rest During an attack the limb or limbs involved are waxy in appearance, congested or mottled in color and decidedly cold to the touch During repose, when no "attack" is present, the patient has no subjective or objective symptoms, save a diminished or, perhaps, absent pulse in the tibial or dorsalis pedis arteries The picture of these symptoms is so striking that it would not be possible in a typical case to confuse the condition with any other, and it is only in the border-line cases that any doubt exists

The pathology is some form of angiosclerosis, either as an obliterating endarteritis, calcification, arteriosclerosis, with or without a similar condition in the veins The angiosclerosis may involve any group of vessels or be confined to the secondary or tertiary branches, or may involve the capillaries If the obliterating process be more advanced, there may be some trophic changes, such as muscular atrophy The nerves may degenerate from occlusion of the vasonervorum, or if the obliteration be very complete, we may have gangrene The angiosclerosis is not sufficient to explain the cardinal symptom of intermittent claudication, for angiosclerosis of a marked degree can often be found in the vessels of the lower limbs where there has been no history of the characteristic cramps and disability on exertion Hunt⁷ says we must assume another factor and that is an inconstant vasomotor spasm Hunt pictures the condition as one where the diminished calibre of the vessels serves to supply the part with enough blood during repose, but when the increased demand of exertion is made, a reflex spasm of the vasoconstrictors occurs, thus further diminishing the calibre of the vessels and restricting the blood supply

It is not unlikely that a similar pathology exists in other groups of vessels and may account for angina pectoris and some intestinal disturbances⁸ There is another class of case where we find the muscular spasms on exertion, but without the peculiar waxy look and coldness of the limbs. Dejerine⁹ describes several of these cases, and ascribes the cause to an endarteritis of the vessels of the spinal cord at some confined area In these cases the lack of proper nutrition at the centre interferes with the proper muscular activity In these cases there was no change from normal in the vessels of the limbs, and they were

cured, or greatly improved, by antisyphilitic treatment. These should not be confused with the intermittent claudication of Charcot.

Thus, we should limit our term intermittent claudication to those cases of angiosclerosis of the limbs where we have the cardinal symptom of the recurring lameness and diminished blood supply, and we must explain this muscular cramp as due to an inconstant vasomotor spasm.

Pain on walking is the only symptom in common between this condition and that first described, namely, erythromelalgia. The absence or diminution of pulse with pallor and coldness of the limb, as compared with the heat, redness and increased pulsations of erythromelalgia, should clearly differentiate between the two.

The commonest of the diseases under description is *endarteritis obliterans* or spontaneous gangrene. Buerger¹⁰ has devised a far better name, and that is thromboangitis obliterans. This disease attacks men much more frequently than women, is nearly always confined to early adult life and is especially common in young Russian Hebrews. The condition is usually confined to the legs, but may spread so as to involve the upper limbs.

Pain, cyanosis and gangrene are the principal symptoms. The pain is not always present, or it may be of great severity. As a rule, it comes on only upon exertion and disappears on rest, although not always. The cyanosis is present usually only when the limb is pendent, and disappears when the limb is elevated. When pendent, the limb is described by most writers as red or reddish-blue, but in all the cases that have come under my personal observation, would more nearly be defined as "dusky" in color. The pain, change in color and swelling may be confined to one or more toes or involve a greater area of the limb. There is absence of pulsation in the dorsalis pedis and posterior tibialis arteries, and sometimes even in the femoral. The disease progresses slowly until gangrene in one or more toes appears. Though the gangrenous areas be amputated, the disease and gangrene encroach on more and more territory until all of the limb has been amputated up to the point where the vessels are healthy. One case comes to mind where all four limbs have been mutilated. Buerger has conclusively shown that in these cases the lumen of the vessels is diminished—not as a result of a proliferation of the intima or media—but by a distinct thrombosis, usually of the arteries, though the veins also may be involved. The thrombosis begins distally and works up, it does not start in the capillaries or arterioles, but in the next higher groups. The microscopic findings clearly separate this disease from inter-

mittent claudication, for in intermittent claudication we have an angiosclerosis due to proliferation of the intima and media as opposed to a thrombosis in thrombo-angietis obliterans. Clinically we have, as guides for a differential diagnosis in thrombo-angietis obliterans, the distinctly colored limb as compared with the waxy white limb of intermittent claudication. The pain is less cramp-like and not so amenable to elevation and rest of the limb, as in cases of intermittent claudication. Gangrene is the usual outcome.

Intermittent claudication and thrombo-angietis obliterans are very easily confused and often described as the same disease, but it is my belief that they should be differentiated. Pathologically they are totally distinct, and it ought to be possible to distinguish them clinically in well defined cases.

In 1862 Raynaud¹¹ described the disease which bears his name, and in 1874 published further enlightenment on the subject. He gave the name "local asphyxia and syncope," with a secondary title of "symmetrical gangrene." As in erythromelalgia the pathology is only speculative, but we do know that there is no organic disease of the vessels producing a permanent diminution of their caliber. Raynaud's explanation, that the "cause of the symptoms is a vice of the capillary vessels," is the correct one.

The disease presents varieties or stages which may follow in order or may be confined to but one or two of the forms. The parts involved are any of the four extremities, together with the nose, ears or cheeks. The fingers and toes are the regions most frequently attacked, and the condition is very apt to be symmetrical in the more advanced cases, though this is not necessarily so.

The simplest stage is that of "regional ischæmia" or the stage of asphyxia without any cause (unless a slight exposition to cold be assigned), when a finger or group of fingers and toes suddenly become blanched, cold and numb. After a time ranging from a few minutes to even many weeks, the symptoms disappear and the part returns to normal.

An exceedingly mild and unimportant manifestation of Raynaud's disease is frequently seen in the so-called "dead finger." The left index is the most frequently involved, and the patient says, "After my cold morning bath my finger is white and numb and does not return to normal until the reaction from the bath is established."

Regional cyanosis or syncope is another stage. Here the affected parts become congested and reddish black, with sensations of cold

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both objectively and subjectively The return to normal occurs after a varying interval

A third variety shows an engorgement of the part with heat and pain

In any of the forms gangrene may supervene The gangrene is usually superficial and involves small areas at the pulps of the fingers and toes, or about the roots of the nails The gangrene which is of the dry variety is apt to be symmetrical, and affects areas previously involved by the vasomotor disturbances After the gangrene is complete, the area sloughs away and the part heals kindly The gangrene may be more extensive and involve a whole digit

Pain is trivial or absent in the ischæmic and syncope stages, but, at or just before gangrene appears, the pain may be very severe, located not only in the areas involved, but radiating in all the limbs and is paroxysmal in character

The disease may be continuous or intermittent (the latter the more frequent) Women are much more likely to be victims of this disease than men The commonest age is about 25 years, although very young children ($3\frac{1}{2}$ years) have been noted

The cause is a spasm of the arterioles or venules or both Spasm of both accounts for the ischæmic type Spasm of the arterioles alone explains the cyanotic type, on the principle of loss of *vis a tergo* Spasm of the venules alone is the cause of the hot, congested form The gangrene follows from the faulty nutrition The vasomotor irritation is probably in the cord accounting for the symmetry The cause of the vasomotor disturbance is probably reflex through the skin or internal genitals (uterus and ovaries)

We must differentiate Raynaud's disease from thrombo-angitis obliterans by the diminished arterial pulsations and the progressive gangrene in the latter, and the transitory character of attacks in the former We have difference in sex and race also as guides

The exciting causes help to differentiate between intermittent claudication and Raynaud's disease

Between the ruboric variety of Raynaud's disease and erythromelalgia, the diagnosis is more difficult, but in typical cases the symptoms in erythromelalgia appear and disappear, depending on the position of the limb, while in Raynaud's disease position plays no part The pain in erythromelalgia is much worse, except as compared to the pain of Raynaud's just as the gangrene is beginning to be noted The pain in erythromelalgia is confined to the affected limbs, whereas in Raynaud's several limbs are involved In erythromelalgia gangrene

does not occur. Elsner¹² reports a case of erythromelalgia of the hand with later development of complete gangrene involving the distal phalanx of the thumb of the same hand, with superficial gangrene of the nose, ear and cheek. He believes he has a case of Raynaud's superimposed on an existing erythromelalgia.

Angioneurotic oedema is hardly likely to be confused with any of the preceding diseases, but may as well be briefly mentioned. This condition seems to be dependent on disturbances of the sympathetic system involving the vasomotor nerves. The characteristic and only marked symptom is an acute non-inflammatory oedema most frequently attacking the face, but often the extremities. The oedema comes out suddenly, without warning, and reaches its maximum in a few hours. There is no pain except from the rapid stretching of the parts and no discomfort except stiffness due to the presence of the swelling. The swelling is circumscribed and either dark red or waxy. The oedema rarely pits on pressure. The condition lasts for hours or days, and disappears as rapidly as it came on. One attack predisposes to another. There are no distinct pathological findings.

The absence of increased pulsation and temperature and freedom from severe pain should readily differentiate this condition from erythromelalgia, and it is not likely to be confused with any of the other conditions described.

Trophic ulcer is a gangrenous ulcer, the result of pressure on some part where the nutrition of the limb is deficient, owing to disease or injury to the nerve supplying the area in question. The condition may be produced by tabes dorsalis, or be dependent on the degeneration of a single nerve.

The usual site for such an ulcer is the ball of the foot. The ulcer progresses, destroying the deeper parts, and finally involves a joint or the bone. Rest of part tends to heal the ulcer, but renewed pressure invariably brings a recurrence. There is but little pain, especially in ulcer due to tabes. The condition is not likely to be confused with gangrene of intermittent claudication or thrombo-angiitis obliterans, or with Raynaud's disease.

The diseases described above have been given in their pure form and as typical examples. As such, there would be but little chance to confuse them and no excuse for this paper. But the border line or atypical cases are the ones that confuse, and these we can only classify by comparing them to some standard. If we have, therefore, established a series of complete typical pictures for comparison, the object of this paper will have been accomplished.

TROPHIC DISTURBANCES OF THE EXTREMITIES

REFERENCES

- ¹ Mitchell Philadelphia Medical Times, 1872
- ² Mitchell Am Jour Med Ec, July, 1878
- ³ Fossier N Y Med Jour, June 14, 1913
- ⁴ Cassirer Die Vasomotor-Tropischen Neurosen Berlin, 1901.
- ⁵ Mitchell Am Jour Med Ec, January, 1899
- ⁶ Charcot Gazette Medicale de Paris, 1850, page 282
- ⁷ Hunt Med Rec, May 27, 1905
- ⁸ Patek Med Rec, February 18, 1905
- ⁹ Dejerine Revue Neurologique, April 30, 1906
- ¹⁰ Bucrger Am Jour Med Science, January, 1910
- ¹¹ Raynaud Thesis 1862, Archives Generales de Medecine, 1874.
- ¹² Elsner Med News, June 19, 1897

CINEMATOPLASTIC AMPUTATIONS *

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It does not appear that amputation for cinematic prosthesis, according to the method of Vanghetti,¹ has received adequate attention in this country. This emboldens me to report two cases in which I have resorted to this procedure, though the report is necessarily incomplete as it has not yet been possible to secure a satisfactory prosthesis, though the patients have good motion in their stumps.

The design of the operation, briefly, is to construct one or more muscular or tendinous loops at the end of the patient's stump, so that the voluntary movements of these loops may be transmitted to the artificial hand. Many artificial arms are already on the market for use with ordinary stumps. In the case of one of those in most general use, the hand is opened by touching a spring with the other hand, and snaps shut again, into a fist, when the spring is released. Such a hand as this, as the manufacturers themselves are forced to admit, is useful for nothing more than "Sunday wear," as there is no voluntary grasp in the hand. A better type of artificial hand is one that secures its motion chiefly by means of straps passed around the patient's body, especially over the opposite shoulder. With one type of arm constructed on this principle, the patient is enabled, presumably only after long and constant practice, to perform almost any motion, and a patient with both arms amputated can dress himself, feed himself, and can make many graceful gyratory motions of little practical use. At the recent meeting of the International Surgical Society in New York City, opportunity was afforded to see a number of patients equipped with arms of this type, but on closer examination I found that while almost any motion was possible, with fingers, thumb, wrist and elbow, yet the grip was very weak (unless the hand was locked by a spring), so that no manual work was attempted. These men make their living advertising this particular make of artificial arm, as travelling salesmen, and probably could make as good a living with-

* Read before the Philadelphia Academy of Surgery, May 4, 1914

¹ G. Vanghetti. *Plastica e Protesi Cinematiche*, Nuova Teoria sulle Amputazione e sulla Protesi. Empoli, 1906. Previous works by this author, on the same subject, had been published in 1898, 1899, and 1900.

CINEMATOPLASTIC AMPUTATIONS

out any artificial arm if they advertised some other article merchandise

But there are very many patients in the laboring classes who are unable to live by their brains, and are utterly incapacitated by the loss of an arm, the most they can do is to act as watchmen, gate-keepers, elevator men, etc. If, however, they could be provided with an arm movable at will and possessing at the same time a grip strong enough to wield

“a shovel, a rake, or a hoe,
a pickaxe or a bill”

or do other laboring, carpentering, masonry or painting work, their earning capacity would be considerably increased, even if it still fell short of the normal

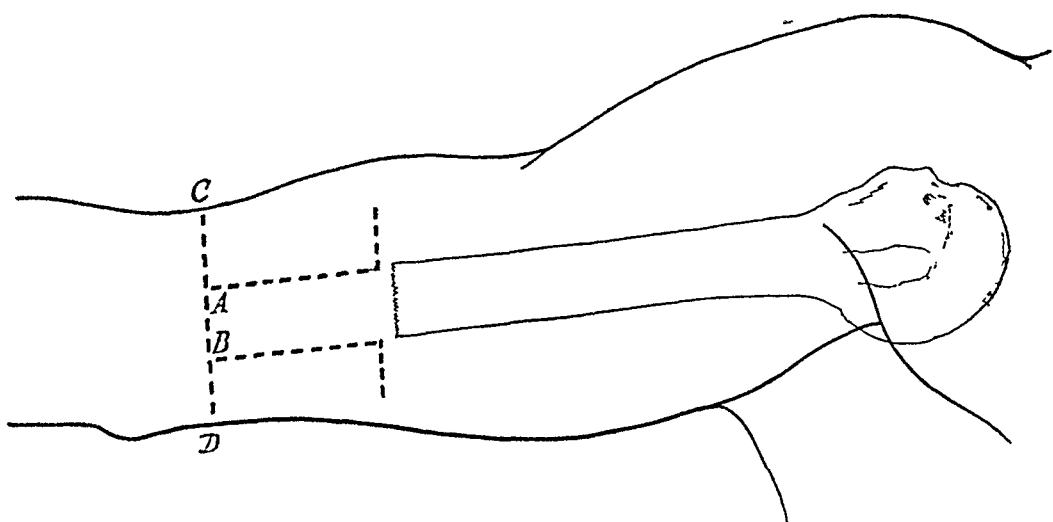


FIG 1 —Cinematoplastic amputation Inner surface of arm, the flap, AB, is to be used to cover the end of the bone, circular amputation at CD

The amputation for cinematic prosthesis is a tedious operation and is not designed as a primary procedure in traumatic cases or in other patients acutely ill. The primary amputation in such cases should be given ample time to heal before the cinematoplastic amputation is undertaken. The level of bone section is determined by the length of the soft parts available for making the muscular loops, the latter should be amply long, so as to allow for subsequent retraction and nevertheless provide for plenty of play beyond the bone end.

In both the cases in which I have adopted this method, the amputation was done through the humerus, by the following technic (Figs 1-4), which differs somewhat from that described by Vanghetti; a small skin flap is outlined over the brachial vessels, as long as the diam-

eter of the limb and nearly an inch wide, with its base, at the level proposed for section of the bone (Fig 1, *AB*), this flap is raised with the subcutaneous tissues, and the brachial artery and vein are ligated and divided just above the level at which the bone is to be sawed. The nerves are divided at the same level or higher, but great care is exercised throughout the operation not to interfere with the nerve supply of the muscles which it is proposed to utilize in the stump. A longitudinal incision is then made on the outer side of the arm (Fig 2), between the flexor and extensor muscles, and these with the overlying skin are then raised from the bone, from the level of proposed bone section down as far as possible. In the arm the musculospiral nerve is now divided, unless it was accessible from the first incision. The soft parts are then divided circularly down to the bone

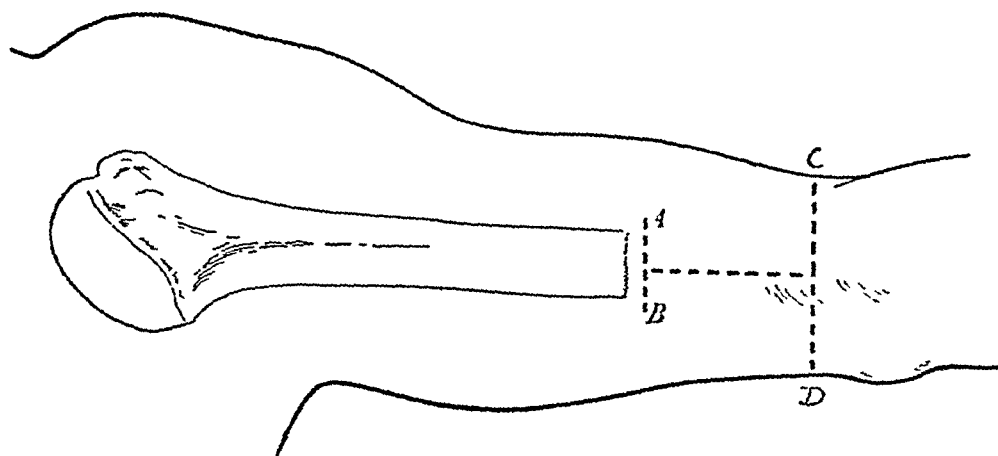


FIG 2—Cinematoplastic amputation. Outer surface of arm, the flap *AB*, is sutured to the line *A'B'*

at the distal limit of healthy tissues, and the musculo-cutaneous flaps are raised, the anterior flap contains the biceps (perhaps also some of the deltoid, brachialis anticus, or coracobrachialis, according to the level), and the posterior flap contains the triceps. The bone is then sawed at the desired level. A small transverse incision is then made towards the centre of the flexor and extensor flaps through the skin only, at their bases (Fig 1), so as to permit of wrapping the skin around the biceps and triceps respectively, in the form of a cylinder. This little procedure when repeated on the outer side of the stump also leaves a free skin margin (Fig 2, *A'B'*) to which may be sutured the end of the skin flap designed to cover the bone. This flap is next adjusted across the end of the bone, and is sutured in place with chromic catgut (Fig 3, *AB* is sutured to *A'B'*). Absolute hæmostasis is important. Then the skin overlying the muscular flaps is wrapped around them in a cylinder, so

CINEMATOPLASTIC AMPUTATIONS

far as is possible (the skin usually is too scanty, and I had to sacrifice some of the muscle in both cases), and is sutured. Next, the free ends of the biceps and triceps are sutured to each other, end on, with buried sutures of chromic gut, and the remainder of the skin is finally closed as accurately as possible. A large rubber tube is passed through the loop thus constructed (Fig. 4), and the stump is lightly dressed

CASE I.—Man aged thirty-five, a steam-fitter by occupation, was in Dr Frazier's service at the Episcopal Hospital. Amputation was done, August 14, 1911, at the middle of the humerus

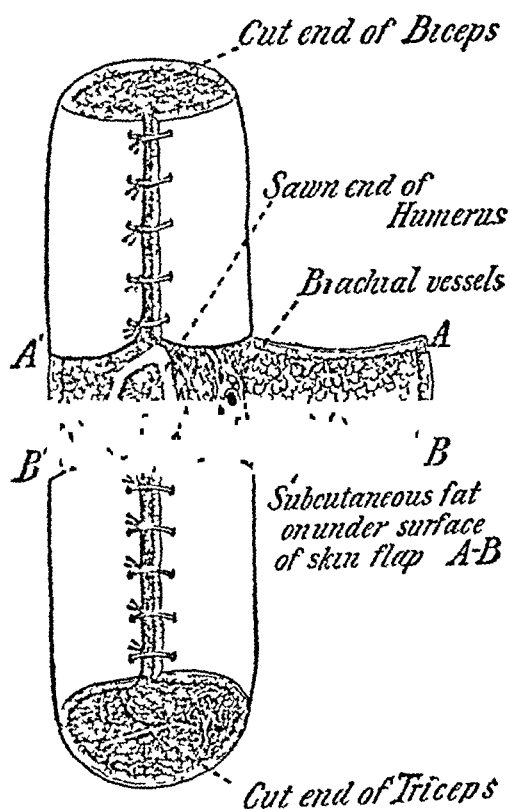


FIG 3 —Cinematoplastic amputation. Diagrammatic view of the end of the stump. The flap, *AB*, is sutured to *A'B'*, and the skin overlying the muscular flaps is sutured around them as a cylinder.

for incurable infection of the hand and forearm, of nearly four months' duration. In this case the cinematoplastic amputation was done as the primary procedure. There was prolonged but not very active suppuration, due chiefly to an intractable dermatitis of the stump, which did not heal permanently until four months after operation. Fig 5 shows his condition four weeks after operation.

As soon as healing was complete he left the city, and I did not see him for almost two years. In November, 1913, he returned to Philadelphia and I found his stump in very good condition. The flaps had retracted considerably, and the loop is now

about one-third smaller than shown in the photograph taken four weeks after operation. His stump is strong and freely movable voluntarily over the end of the humerus, and there is a direct pull of at least half an inch (1.25 cm). He has surprising strength in the muscular loop, and if fitted with a proper prosthesis should have a strong grip in the artificial hand.

CASE II—Young man of twenty-one years, a painter by trade, whose arm had been amputated first for a crush at the age of fourteen years, at about the middle of the humerus. When nineteen years of age (in 1910) re-amputation had been done for a conical stump, the bone being divided this time through the insertion of the deltoid. Though this left a very short stump, it seemed that a cinematoplastic amputation should increase its

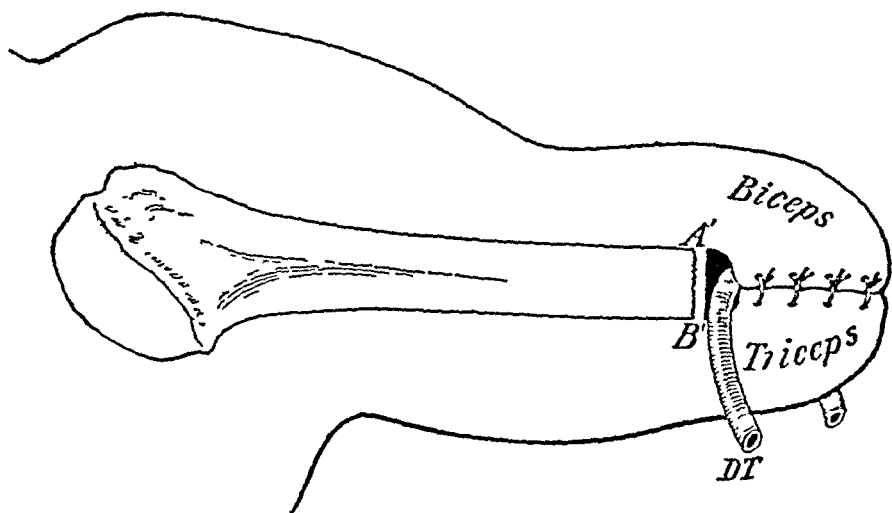


FIG 4—Cinematoplastic amputation. The biceps has been sutured to the triceps, and a rubber tube is passed through the loop before dressing the stump.

usefulness. The operation was done in Dr Frazier's service at the Episcopal Hospital, on October 18, 1912. Healing was prompt and good power was secured in the stump, with nearly one inch of direct pull. The patient himself claims at least an inch and a quarter (3 cm,) but I think this is an exaggeration. Fig. 6 is from a photograph made five months after operation.

This patient also was lost sight of for a long time, and only recently has he returned for observation. He has spent some time in jail, has neglected his stump, and thought the loop had closed up, but a strip of gauze was easily drawn through, though it caused a little bleeding, and a very slight discharge persisted as long as the gauze was kept in place. The stump is very strong, however, and the loop can be both flexed and extended very actively.



FIG 5—Cinematoplastic amputation, first patient, four weeks after operation

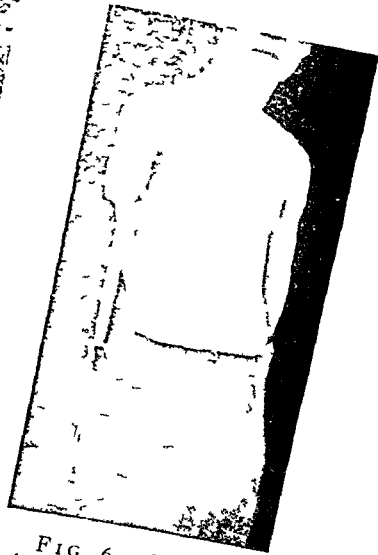


FIG 6—Cinematoplastic amputation, second patient, five months after operation



FIG 7—Cinematoplastic amputation, second patient, temporary prosthesis

CINEMATOPLASTIC AMPUTATIONS

I myself and the patients themselves have consulted several manufacturers of artificial arms, with the object of having a cinematic prosthesis applied. The manufacturers invariably recommend and prefer artificial arms of their own manufacture and decline to manifest any enthusiasm about making artificial arms with a different mechanism. Finally I induced one manufacturer to make the attempt, but the patient then in question declined to pay for any "experimental" arm unless it proved absolutely satisfactory. This guarantee the maker declined to give, and the proposed deal fell through. This patient (Case I) then conceived the idea of making his fortune by inventing an artificial hand for himself, having it patented, then inducing some manufacturer to put it on the market and pay the royalties to him, while he himself would enjoy life travelling over the world as a sales-agent. Though he assured me he would send all the patients with arm stumps to me to have a cinematoplastic amputation performed, I have heard nothing further from him, and fear his scheme is not working out as well as he had anticipated.

Finally I determined to have a very simple apparatus constructed for the second patient, who was more tractable, and appeared to be willing to become the subject of experimentation. In default of any better contrivance, and purely as an experiment, I instructed Mr Henry Saur of this city to make a pair of fingers, or finger and thumb in the form of pincers, attached to an arm socket, and worked on the principle of levers, by means of a cord which passes through the loop in the patient's stump. If this proves practicable, it can be extended to include more fingers or a complete artificial hand.

I may add that Vanghetti himself experienced very great difficulty in having a suitable prosthesis constructed, and the fact that he succeeded at last probably is due to his having as great a genius for mechanics as for surgery. However this may be, the various designs of apparatus which he gives in his book have not served to inspire any useful ideas in the mechanicians to whom I have submitted them. Hence I make this report of these amputations for cinematic prosthesis merely to show that the construction of the cinematoplastic stump is quite possible, and in the hope that someone with more mechanical ability than I myself possess will undertake the further problem of designing the prosthesis.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY

*Stated Meeting, held at the New York Academy of Medicine,
April 22, 1914*

The President, DR FREDERIC KAMMERER, in the Chair

GANGRENOUS APPENDICITIS IN AN INFANT TEN WEEKS OLD

DR CHARLES H PECK presented a baby girl who, when ten weeks old developed a gangrenous appendicitis, for which operation was done January 27, 1914.

The baby reacted well and took nourishment for 48 hours, when persistent vomiting set in, lasting for twelve hours, and during the third and fourth days after the operation the child was in a critical condition. Improvement then set in, and from that time on its convalescence was uneventful. The drain was removed on the fourth day. The wound healed kindly, and there was no evidence at any time of an extension of the peritonitis.

PARTIAL GASTRECTOMY AND PYLORECTOMY

DR J. F ERDMANN presented a married woman, thirty-five years old, who had suffered for over two years with severe pain in the epigastrium, with pyrosis. She had lost 48 pounds in weight in less than two years, and was profoundly anæmic. The pain usually came on at night, about two hours after dinner, and was at times very severe, passing directly through to the back. There was occasional vomiting with the onset of the pain, with food contents of the last meal only. There was no history of blood in the vomitus. The patient could localize a certain spot where the passage of food gave rise to exquisite pain.

When this patient came under Dr Erdmann's observation, on December 30, 1913, examination revealed a movable mass in the epigastrium, about the size of a small fist. On January 5, 1914, upon exposure of the stomach, a tumor was found involving the entire lower half of the stomach, necessitating a two-thirds excision of that organ. The glands were slightly enlarged.

Repeated examinations of sections of the large, fungating mass found in the removed specimen had failed to reveal any signs of malignancy. The patient had gained fourteen pounds in weight since the operation, and was at present in excellent condition.

EXTENSIVE GASTRECTOMY FOR ADENOCARCINOMA

PARTIAL GASTRECTOMY, PYLORECTOMY, CHOLECYSTECTOMY AND CHOLEDOCHOSTOMY

DR. ERDMANN presented a married woman, sixty-four years old, upon whom he had first operated three or four years ago, doing a right nephrectomy for a calculous hydronephrosis, and a right oophorectomy, with appendectomy.

In June, 1912, she was again operated on for suspected gall-bladder trouble, and, upon exposure, a large carcinoma, involving the pylorus, was revealed. In addition, the gall-bladder was filled with stones, and numerous small calculi were found in the common duct. There was evident involvement of the neighboring glands.

A partial gastrectomy and pylorectomy were done, and, in addition, a cholecystectomy and choledochostomy. The patient made a rapid and uneventful recovery, and up to the present time showed no evidence of a recurrence.

EXTENSIVE GASTRECTOMY FOR ADENOCARCINOMA

DR. ERDMANN presented a man, thirty-three years old, who was operated on November 21, 1913, for obstruction, characterized by symptoms that were indicative of either ulcer or malignancy and rather pointing to the latter. Operation revealed an adenocarcinoma, with involvement of the glands, necessitating a gastrectomy, over five-sixths of the stomach being removed. Within a few weeks after the operation, the patient's weight had increased from 116 to 138 pounds, and up to the present time he had enjoyed excellent health.

DR. ERDMANN also presented a man, forty-eight years old, who came under his care on December 16, 1910, with the history of epigastric pain following the ingestion of food and at other times. The history dated back four months. There was a feeling of heaviness after eating, with belching, and he had noticed that certain kinds of food disagreed with him more than others. He had lost from ten to fourteen pounds in weight.

Examination revealed a markedly anæmic man, with a painful mass in the epigastrium. On December 20, 1910, a pylorectomy and partial gastrectomy was done, about five-sixths of the stomach being excised.

The patient made a good recovery from the operation, and on February 16, 1911, his weight had increased from 129 to 144 pounds, a gain of fifteen pounds. On December 20, 1911, his weight, which had been as high as 152 pounds since the operation, was 141 pounds. On July 7, 1913, he reported that he was in excellent condition, and

NEW YORK SURGICAL SOCIETY

could eat anything without trouble At the present time he showed no evidence of any recurrence, and his weight was 136 pounds

PERFORATED GASTRIC ULCER

DR ERDMANN presented a man, twenty-eight years old, who came to him on February 19, 1914, with the history that about six o'clock that morning he had a severe attack of epigastric pain, felt nauseated and perspired freely Upon inquiry he said he suffered from abdominal cramps at various times When Dr Erdmann saw the patient, he presented evidences of shock, with marked abdominal rigidity and tenderness A diagnosis of perforated gastric ulcer was made, and an immediate operation revealed a perforation on the lesser, anterior curvature of the stomach, with an indurated surrounding area the size of a silver half dollar There had been some escape of gastric contents into the peritoneal cavity, and a large amount of exudate surrounded the ulcer In view of the man's condition at the time, it was only possible to place a patch of gastrohepatic omentum over the perforation, and remove the appendix through a counter stab-wound, with drainage at the side of the ulcer The patient made a good recovery and left the hospital in three weeks Since the operation he had taken on about eight pounds in weight

PERFORATED DUODENAL ULCER

DR ERDMANN presented a man, forty-five years old, who was seen by him with Dr MacKenty about 10 30 P M on November 5, 1913, with a history of having had previous gastric disturbances typical of duodenal ulcer About three hours before Dr Erdmann saw him he had had a sharp attack of pain in the abdomen, for which his family physician had administered one grain of morphine, without relief The pain was limited to the epigastrium, and there was board-like hardness of the upper segment of the abdomen

An immediate operation revealed a perforated ulcer in the first portion of the duodenum, and the abdomen was found to be filled with stomach contents The ulcer was closed and inverted, and the appendix was removed through a counter stab drain opening

The patient was discharged two and a half weeks after the operation He was now in excellent health, and his weight had increased from 135 to 165 pounds

PERFORATED DUODENAL ULCER

DR ERDMANN presented a man, thirty-nine years old, who was first seen by him at 11 P M on March 17, 1914, with the history that

PERFORATING ULCER OF DUODENUM

at two o'clock in the afternoon on that day he felt a slight uneasiness in the abdomen. Two hours later, after drinking a glass of beer, he was suddenly seized with a sharp pain, which persisted, so that he called in his family physician, who administered morphine.

When Dr. Erdmann saw the patient there was marked tenderness over the right upper zone of the abdomen, and upon inquiry the patient stated that he had had numerous attacks of indigestion, with pain in this area. The case was regarded as one of perforated duodenal ulcer, and at the operation, which was done an hour and a half later, a large perforation was found in the first portion of the duodenum. The peritoneal cavity was more or less flooded with a murky fluid. Excision of the ulcer was done, together with posterior gastro-enterostomy, and the appendix was removed through a counter stab drain wound.

The operative wounds in this case healed readily, but the patient's convalescence was marked by morning rises and evening falls in temperature, ranging from 103° in the morning to 100° at night. Physical examinations, blood counts, etc., revealed no cause for this temperature until about the sixteenth day after the operation, when the sputum showed numerous tubercle bacilli. The case was pronounced by Dr. Lambert as one of milary tuberculosis, and the ultimate outlook was not encouraging.

PERFORATING ULCER OF THE DUODENUM

DR. ERDMANN presented a physician, thirty-three years old, who for a number of years had suffered more or less from intestinal disturbance, and who for the past two years had had definite symptoms, *i e*, pain, usually about three hours after eating, and occasionally at night. At one time, over a period of three days, his stools had been tarry. There was no history of vomiting or colic. He had lost about 30 pounds in weight during the preceding year.

Palpation revealed a tender spot in the region of Robson's point. An operation, done two weeks ago, showed an ulcer of fair size in the first portion of the duodenum. While attempting to excise the involved area, the ulcer ruptured. The excision was then completed, together with a gastro-enterostomy and appendectomy. In doing the gastro-enterostomy, two cysts were found on the convex surface of the first portion of the jejunum, one as large as a French pea, the other ten times larger. Both were excised.

The patient was discharged from the hospital in twelve days. He has since gained 25 pounds.

INDURATED PERFORATING ULCER OF THE DUODENUM AND
PYLORUS, PYLORECTOMY

DR ERDMANN presented a man, forty-nine years old, who was admitted to the medical service of the Post-Graduate Hospital on November 19, 1913, and transferred to the surgical wards on December 5 with the diagnosis of ulcer of the pylorus or duodenum

Operation, December 5, 1913 This consisted of a pylorectomy, with posterior gastro-enterostomy The patient made a less rapid recovery than in the type of non-excised ulcer, but his subsequent condition indicated a positive cure He had remained entirely free from symptoms, and had shown a marked increase in weight

DISLOCATED SEMILUNAR CARTILAGE

DR ALFRED S TAYLOR showed two cases where this injury of the knee had occurred The first patient was a young man, who, while playing ball, gave his knee a sudden twist, and after this injury he had all the symptoms of a foreign body in the knee-joint About a year ago he was operated on at the Fordham Hospital, where a foreign body, the size of a marrowfat pea, was removed from the upper half of the left knee-joint There was no improvement after this operation, and as the joint still gave him constant annoyance, he returned to the hospital, where the condition was diagnosed as a probable dislocated semilunar cartilage Upon exposure of the joint the cartilage was found split, with a small fragment wedged in between the joint ends

Dr Taylor's second case was one of hypertrophy of alar ligament of the knee, and upon exposure, the ligament was found considerably congested The symptoms in this case were due to the presence of a small pedunculated enlargement of the fringe of the alar ligament, which was removed Since then the patient had had no further trouble

DR HOWARD D COLLINS recalled a case where the semilunar cartilage was split longitudinally, and upon exposure, the torn cartilage presented the appearance of a button-hole Probably, in the course of time this would have gone on to a condition similar to that described by Dr Taylor The speaker said that in cases where we had the characteristic symptoms of a dislocated semilunar cartilage, *i e*, pain and locking of the joint, the latter, upon exposure, should be carefully searched for adhesions of the ligamentum alaria

DR ROYAL WHITMAN said he was a believer in the prompt operative treatment of dislocated semilunar cartilage, because after the dislocation had recurred several times, it was very unlikely that it could again become fixed It was therefore practically a foreign body The

MULTIPLE BRAIN TUMOR

speaker said he had removed the internal cartilage from both knees and both cartilages from one knee without any resulting disability. A very satisfactory method was to make a simple lateral incision with the knee flexed. In that position the cartilage could be readily removed by continuing the incision through it and separating its attachment to the internal lateral ligament. He was in favor of taking out the entire cartilage rather than the detached part. He called attention to the importance of the after-treatment of the weak feet, which he believed often predisposed to the injury and which, if uncorrected, would interfere with recovery.

DR. H. H. M. LYLE referred to the importance of inspecting the lower end of the femur in these cases, as it was often roughened. He recalled one case of dislocated semilunar cartilage in a base-ball player where, after removing the cartilage, the lower end of the femur was found to be so rough that it had to be chipped off. That patient had since been able to resume his place on the base-ball team.

In operating for dislocated semilunar cartilage Dr. Lyle always used the Robert Jones incision and has found it much superior to the ordinary vertical incision.

DR. F. W. KAMMERER spoke of several cases which he had operated on by a transverse incision. They had all done well. He especially mentioned one case, in which the middle portion of the internal semilunar cartilage had been torn from the capsule, the anterior and posterior ends having remained firmly attached to the tibia. Furthermore, the middle portion had been turned over so that it lay between the two condyles of the femur and was dislodged from this position with difficulty. It was then sutured to the tibia. The patient made an uneventful recovery and had no further trouble while under observation.

MULTIPLE BRAIN TUMOR

DR. CHARLES A. ELSBERG presented a man from whom he had removed two brain tumors. The patient was admitted to the New York Neurological Institute, in the service of Dr. Pearce Bailey, with the history that he had sustained a severe injury to the head twelve years before. For a year following the injury he had suffered from severe headaches, and had noticed a swelling of the skull in that region.

The only symptom shown by the patient at the time of his admission was a very marked disorientation. As soon as he left his room in the hospital he would be unable to find his way back, even if he stood just outside of the door. There was a marked swelling of the cranial bones in the parietal region near the median line, at the site of the former scalp wound.

At the first operation, about one year ago, the bone was removed over this region, and the dura exposed. The bone was very soft, about two centimetres in thickness, and so extremely vascular that the bleeding could only be controlled with difficulty. The dura underneath was much thickened, and the seat of a tumor formation.

At the second operation, done several weeks later, a piece of dura fully six centimetres in diameter was removed, together with two large, subcortical growths, each the size of an egg. These tumors were easily shelled out from underneath the cortex of the parietal lobe after the cortex had been incised. Both lay near the median line.

At the third operation an attempt was made to excise the diseased dura, but inasmuch as the tumor formation extended over the greater part of the falx cerebri and tentorium cerebelli, the attempt had to be abandoned. After the second operation, all of the patient's symptoms disappeared, and his condition seemed absolutely normal. He had remained so up to the present time, more than a year after the operation. The pathologist reported that the growths were endotheliomata, and that the dura was the seat of metastatic growths, while the process involving the bone was a rarefying osteitis.

Dr. Elsberg said the point he wished to emphasize in connection with this case was not the freedom from recurrence, but the fact that all of the symptoms had disappeared and the patient had remained well for one year, in spite of the fact that a large infiltration of the dura had not been removed.

BILATERAL PARALYSIS OF THE TRAPEZIUS MUSCLES AFTER NERVE DIVISION

DR. ARTHUR S. VOSBURGH presented a man, forty-five years old, with paralysis of both trapezii. The history obtained was that the patient had been operated upon seven years ago for tubercular cervical adenitis, and following this operation he noticed that his shoulder on that side fell forward and downward. Three years later he underwent an operation for a similar condition of the lymph-nodes on the opposite side of the neck, and this, too, was followed by a drooping of the shoulder. In addition to these operations, many minor operations were performed for recurrences and persistent sinus formation, as shown by multiple scars in the anterior and posterior triangles of the neck.

The paralysis in this case was limited to the trapezii muscles. The sternocleidomastoids were not involved, nor were the deltoids or serrati, and Dr. Vosburgh expressed the opinion that the paralysis in this case following the operative procedures, the one three years after the other, precluded the possibility of a lesion due to other causes.

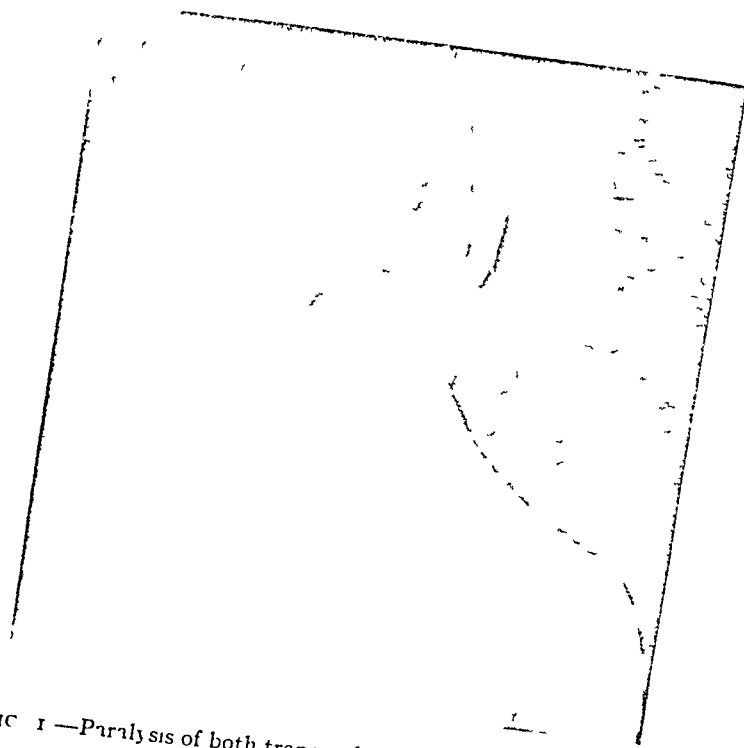


FIG 1 —Paralysis of both trapezii from division of nerve supply



FIG 2 —*a*, upper portion of thorax rendered prominent by the falling downward and forward of the shoulder girdle, *b* scapula fallen forward and rotated downward

paralysis of the trapezius. He recalled a recent case of tubercular lymph-glands in the neck in connection with an old sinus formation where the spinal accessory was involved in the cicatrix and was accidentally ruptured. It was sutured, and he hoped that the patient would suffer no ill effects from the injury.

Replying to Dr. Elsberg, the speaker said that from a rather brief review of the literature, he had gained the impression that the Aran-Duchenne type of progressive muscular atrophy usually occurred in young children, involving the shoulder girdle and generally the deltoid and the serrati. Here, these muscles were not involved. The duration of the paralysis in this case, too, militated against that diagnosis.

HAIR-BALL IN THE STOMACH

DR. WALTON MARTIN presented a woman, twenty-four years old, who was admitted to the hospital on April 1, 1914. The patient had been an inmate of a public institution and was rather dull mentally. The history obtained was that she had been troubled with nausea for three weeks, the attacks occurring two or three times daily, usually before meals and lasting for ten or fifteen minutes. There was no history of pain, vomiting nor eructations of gas. The appetite was poor, there had been some constipation, and frequent, severe headaches.

When the patient was admitted to the hospital she presented the appearance of a poorly developed and poorly nourished woman. She was rather nervous, but did not look ill. Upon examination, there was slight tenderness and rigidity from just below the ensiform cartilage to one inch above the umbilicus, and a short distance below and to the right, between the costal margins, there was a hard, somewhat nodular tumor, slightly tender and freely movable in all directions. She was given a bismuth meal and a series of X-ray pictures were made by Dr. L. T. LeWald. His attention was arrested by the peculiar way in which the stomach outline was evident after most of the bismuth meal had passed out of the stomach, he was struck by its similarity to a case reported by C. Thurston Holland in the *Archives of the Roentgen Ray*, March, 1914, and upon these findings he made a diagnosis of hair-ball in the stomach.

When Dr. Martin opened the abdomen, the stomach was found to be moderately enlarged, on a level with the navel. When opened, the stomach was found to contain a complete cast made up of hair, coated with bismuth. This was removed, and the gastrotomy and abdominal wounds closed. The patient made a normal convalescence and left the hospital in three weeks' time. She admitted that she had been in the habit of occasionally plucking a hair from her head and swallowing it.

DR. CHARLES N. DOWD referred to the relative importance of the spinal accessory nerve, and the branches of the cervical plexus in the innervation of the trapezius muscle. In a much used method of removing tubercular neck nodes the branches of the cervical plexus are sacrificed and only the spinal accessory preserved. In many instances this is sufficient to provide good innervation to the trapezius muscle. In other instances it might not be sufficient. He asked if any of the members present had found the eleventh nerve insufficient for this purpose.

DR. FRANK S. MATHEWS said he had seen the spinal accessory nerve accidentally divided and the injury not followed by shoulder drop.

DR. ELLSWORTH ELIOT said that some years ago he became interested anatomically in the spinal accessory nerve and the motor branches of the cervical plexus, and in a number of instances he found that the development of these nerves differed very materially. In some cases the termination of the spinal accessory passing to the trapezius branch was exceptionally well developed, in others it was not developed so well, while in rare instances it was entirely absent. Again, he had found that with a weak spinal accessory supply, the branches of the cervical plexus supplying the trapezius were exceptionally well developed, and *vice versa*. This might be accounted for by variations in the anastomosis between the spinal accessory nerve and the cervical plexus. In those cases where the spinal accessory supply of the trapezius was well developed, the degree of anastomosis between the cervical plexus and the spinal accessory was not well marked.

In operating on tubercular glands in the neck, Dr. Eliot said, he thought the spinal accessory should always be preserved, if possible. When its division was necessary, a neurorrhaphy could be done with very good expectation of reunion.

DR. ELSBERG asked Dr. Vosburgh whether a complete neurological examination had been made in this case. In many respects the case had the appearance of the Aran-Duchenne type of progressive muscular atrophy beginning in the shoulder girdle.

DR. VOSBURGH, in closing, said he could confirm Dr. Eliot's anatomical findings in this field, which were based by the latter on a very extensive experience in the dissecting room. The speaker said that he also had noticed that the nerve supply of the trapezius, which normally comes from both the spinal accessory and branches of the anterior divisions of the third and fourth cervical nerves, often formed a plexus formation, and the development or presence of the one was in inverse ratio to the presence or development of the other. That division of the spinal accessory alone was not, as a rule, followed by complete

paralysis of the trapezius. He recalled a recent case of tubercular lymph-glands in the neck in connection with an old sinus formation where the spinal accessory was involved in the cicatrix and was accidentally ruptured. It was sutured, and he hoped that the patient would suffer no ill effects from the injury.

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BILIARY SURGERY

Dr. Martin said this case was of interest because the diagnosis was made by the X-ray prior to the operation. There were two cases on record in which the diagnosis was thus established

Up to October, 1913, the records showed 35 cases of gastrotomy the removal of hair-balls from the stomach, with no fatalities.

BILIARY SURGERY WITH AN ANALYSIS OF 270 OPERATION

DR JOHN F ERDMANN read a paper with the above title for see page 665

Dr. ROBERT T MORRIS said he had removed the gall-bladder in many of his cases. In those cases where it was permitted to remain, the question arose why, with the original conditions persisting we did not have recurrence more often than was actually the case? One explanation was that following such an operation, the presence of drainage apparatus caused an interstitial fibrinous deposit in the walls of the gall-bladder, with subsequent contraction, so that in these cases, after drainage, the gall-bladder seldom returned to its original dimensions

DR CHARLES H PECK said that while he did not have the exact figures at hand, he was under the impression that in over fifty per cent of the biliary cases where he had been called upon to operate, he had done cholecystectomy. When the walls of the gall-bladder were apparently normal, he limited himself to cholecystostomy, but when they were evidently diseased, he thought a cholecystectomy preferable.

Speaking of the re-formation of biliary calculi, Dr. Peck said he had recently done the third operation on a patient for recurrent stones. Six years ago this patient was first operated on for biliary calculi, the gall-bladder, containing stones, was removed. Two years ago the common duct was opened, and a number of stones removed, and recently Dr. Peck said, he had opened the common duct for a recurrence of symptoms, and had found it filled with inspissated bile and a large number of stones. The walls of the duct were much thickened, so that patient would doubtless have a further recurrence. In another case, where he did a cholecystostomy, with the removal of about 6 good sized stones from the gall-bladder, and a choledochostomy, with the removal of 12 large stones from the common duct, the patient, within one year, was obliged to submit to a second operation for the removal of stones in the common duct. These had either re-formed during the interval, or else had escaped a very careful exploration made at the time of the original operation.

DR GEORGE WOOLSEY thought that secondary operations on the gall-bladder and ducts were among the most difficult that the surgeon had to do in gall-bladder surgery. In all of the cases where he had be

NEW YORK SURGICAL SOCIETY

called upon to operate for a recurrence of symptoms, he was inclined to believe that the stones were left behind at the primary operation, and that they were not newly formed stones

It is an easy matter in these cases, Dr Woolsey said, to overlook the presence of small stones unless the finger was introduced and the gall-bladder or duct carefully explored

DR ROBERT H M DAWBARN said that a few years ago he saw a middle-aged woman at the Ossining Hospital, who was suffering from gall-stones, her gall-bladder being very large and distended, and he made preparations to operate on her on a certain date. On the very night before the day set for the operation, while the patient was lying quietly in bed, trying to go to sleep, she felt a sudden, severe pain in the region of the gall-bladder, and quickly showed symptoms of mild shock. When Dr Dawbarn opened the abdomen, he found at least fifty gall-stones in the peritoneal cavity, dispersed everywhere by peristalsis, among the bowels. These were removed, together with the gall-bladder, which had a tear, five inches long, involving practically the entire length of it, and already showing signs of healing edges. This curious specimen he has saved. The patient made a good recovery.

There were five species of mammals, Dr Dawbarn said, that have no gall-bladder, namely, the horse, the elephant, the ass, the rhinoceros and the true deer. In spite of its absence, the late Dr Nicholas Senn had reported cases seen in India during his trips around the world, where elephants died from gall-stones or disease of the liver produced by such stones in the liver substance.

DR CHARLES N DOWD referred to the effect of cholecystitis upon the pancreas. A persistently inflamed gall-bladder might lead to pancreatic inflammation as had recently been recorded both by Doctor Mayo and Doctor Deaver, he had personally observed this sequence. The danger of this occurrence frequently made a reason for cholecystectomy.

Stated Meeting, held at the New York Academy of Medicine, 17 West Forty-third Street, Wednesday, May 13, 1914

The President, DR FREDERIC KAMMERER, in the Chair

SERIAL PLICATION OF A LARGE VENTRAL HERNIAL SAC

DR ROBERT T MORRIS presented a woman, fifty-four years of age, who had a post-operative ventral hernia hanging below the pubes. Two unsuccessful operations had been done previously in the case. After freeing the skin Dr Morris examined the contents of the sac through

TRANSFRONTAL OPERATION FOR TUMOR OF HYPOPHYSI

a small opening. Adhesions of the viscera were so extensive it was feared that separation of loops of bowel from the walls of the would endanger its vitality. Serial circular plication of the sac then made with kangaroo tendon. Each suture encompassed an about three inches in diameter. Six such sutures applied consecutively reduced the diameter of the sac about eighteen inches, leaving its face on a plane with the normal abdominal wall. The wound healed by primary union, although the patient had 5 per cent of sugar in urine before going upon antidiabetic diet in the hospital. Inversion of the sac, its adherent viscera had not resulted in any interference with bow movement in this particular case.

HABITUAL DISLOCATION OF THE PATELLA

DR. CHARLES A. ELSBERG presented a patient upon whom he had operated for habitual outward dislocation of the patella. The patient had been incapacitated for work and was unable to walk, because each attempt at flexion of the knee, the patella would slip outward and the patient would fall to the ground. The operation done was recommended by Krogus a number of years ago. This consists in transferring a flap of the vastus internus muscle from the inner side of the thigh to the outer side, implanting it in an incision in the vastus externus. By this means the structures to the inner side are shortened and those to the outer side lengthened. The result in this patient operated upon eight months ago, was very satisfactory. On flexion of the knee the patella remains in its place on the condyles and the patient has regained full power over her limb.

MULTIPLE LYMPHOSARCOMA OF BOTH BREASTS

DR. ELSBERG presented a patient upon whom he had operated for multiple round-cell sarcomata of both breasts. The patient had been nursing a child for eight months and six months before multiple tumors appeared in both breasts. These enlarged rapidly so that when the patient first entered the hospital both breasts were much enlarged and filled with tumors of various sizes. The operation consisted of subcutaneous extirpation of both breasts, and the patient was presented to show how small a deformity was left after such subcutaneous extirpation. The glands in the axillæ were not affected. The pathological report was round-cell sarcoma.

TRANSFRONTAL OPERATION FOR TUMOR OF THE HYPOPHYSI

DR. ELSBERG also presented a patient upon whom he had done transfrontal operation for tumor of the hypophysis. The patient was

young girl whose menstruation had ceased a year before, and who had complained of increasing difficulty in sight. When she entered the hospital the left eye was absolutely blind, and there was temporal hemianopsia on the right. She had been operated upon twice by the transphenoidal route without benefit to her eyes. Through the transfrontal method described by the author, the hypophysis was exposed and part of a soft vascular tumor removed. The pathological report is fetal adenoma. Convalescence was uninterrupted. At the present time the pupil of the left eye again reacts to light and the patient has regained light perception in that eye, while acuity of vision in the right eye is much improved and the field of vision considerably enlarged. Patient was presented six weeks after her operation in order to show how slight the disfigurement was after this method of operation.

TRANSFUSION FOR POST-OPERATIVE HEMORRHAGE IN CASE OF OBSTRUCTIVE JAUNDICE

DR E. H. POOL presented a woman thirty-eight years of age, who, last spring, about seven months before the operation, had suffered from septicæmia, the infection originating in the throat, her blood repeatedly gave pure cultures of streptococcus. She received frequent doses of autogenous vaccines and also antistreptococcus serum prepared by Dr Krumweide, of the Board of Health, who also made the cultures from her blood. After a prolonged illness with numerous complications, she recovered. The details of this illness have been reported by Dr N. B. Potter and Dr Krumweide. About the first week of October, 1913 (as nearly as can be determined), she developed jaundice which became extreme. Dr Pool saw her later with Dr Potter, her symptoms indicated a stone in the common duct. Fear of anaphylaxis, on account of the previous serum treatment, deterred Dr Pool from administering serum as a prophylactic measure prior to operation, but she received calcium lactate for five days.

The patient was operated upon on November 3, 1913. Several stones were removed from the common duct. The possibility of post-operative hemorrhage was realized and consequently unusual care was exercised to secure absolute hæmostasis.

On the second day after operation fresh blood was noticed on the dressing. The bleeding continued freely. The sutures were removed and the superficial parts of the wound inspected, with the intention of trying to find and secure the bleeding vessels, but it was found that a general oozing was taking place from all cut tissues. On the evening of the second day the patient went into collapse and an infusion was given with only transitory improvement. Dr Welsh administered

SPLENECTOMY FOR BANTI'S DISEASE

human blood serum at 9 30 P M and at 2 A M The following morning the patient vomited a large amount of bloody fluid, bleeding from the wound was active, the coagulation time was fifteen minutes; hæmoglobin 40 per cent, red cells, 2,700,000. At noon (third day) a transfusion of 380 c c was given by Dr Lindeman That evening the coagulation time was six minutes, the bleeding less, and the condition of the patient improved. The next morning the dressings were again saturated with blood and the coagulation time was eight minutes That afternoon another transfusion was given of 220 c c The following morning the coagulation time was three and one-half minutes, the bleeding had stopped and the condition of the patient was much improved Bleeding, however, recommenced and the condition gradually became worse, and the patient was in very poor condition two days later (the seventh day after operation), when the coagulation time was twelve minutes, hæmoglobin 35 per cent, red cells 1,800,000 A transfusion of 900 c c was given and the patient's condition again improved The next day the coagulation time was five minutes, hæmoglobin 46 per cent The bleeding was permanently stopped and the patient made an uninterrupted recovery and was discharged on the twenty-seventh day

In all three transfusions the patient's sister was the donor. Attention was called to the marked change in coagulation time following each transfusion and the diminution or cessation of hemorrhage coincidently with and roughly in proportion to the shortening of the coagulation time

SPLENECTOMY FOR BANTI'S DISEASE ANTE OPERATIVE TRANSFUSION

DR E H. POOL presented a woman thirty-nine years of age, who was admitted to the Medical Service of Dr William Williams at the New York Hospital on February 4, 1914, complaining of weakness and a mass in the abdomen She had come to this country three months before admission On the voyage she was very seasick and vomited frequently, the vomitus on several occasions containing considerable blood. She also noticed that her stools were very dark For the last three or four months she had been losing in strength and had felt too weak to work She had noticed no change in the color of the skin, had no pain, and no headache Her bowels were regular and she presented no urinary symptoms For nearly twenty years she had had a large mass in the left side of her abdomen which had been increasing gradually in size but had never caused her pain or discomfort, or interfered with her leading an active life No one else in the patient's family had had splenic enlargement so far as could be

ascertained The patient had never had an acute illness, but had worked for the past twenty-five years as a laborer in the fields in Italy She had never had malaria

At the time of admission to the hospital the patient was poorly nourished, looked anæmic, had a yellow-ivory colored skin and yellowish sclera Pulsation was visible in the veins of the neck The pulse in the radials was equal, regular, small, and of poor force and tension There was no sclerosis The apex beat of the heart was three and one-half inches to the left in the fifth space, the right border of the heart was one-half inch to right of sternal line At the apex and base there were fairly loud systolic murmurs A large mass, evidently the spleen, was palpable in the abdomen Its limits were one inch to the right of the midline, 10 inches below the xyphoid in the midline, 8 inches below the costal margin in the mammary line, 5 inches below the costal margin in the anterior axillary line The mass was firm, somewhat movable, and not tender The edge of liver was palpable two centimetres below costal margin The hæmoglobin was 28 per cent, red cells, 1,600,000 The Wassermann reaction was negative The weight of the patient on admission was 102 pounds The patient was transfused by another surgeon on February 15, 1914, about 600 c c having been given Hæmolysis resulted and it was thought that the condition of the patient was too poor to warrant a splenectomy At 8 30 P M, on March 7, the patient began to vomit bright red, bloody fluid, six times in twelve hours, in all 42 ounces At 11 P M the pulse was 120 and became weak and small An intravenous infusion of 24 ounces of normal saline solution was given She continued to vomit blood at frequent intervals for the next four days At intervals during this time horse serum was administered subcutaneously without effect Her movements at this time contained considerable blood The pulse continued very weak and small On March 26, she had a chill, lasting 20 minutes, and one-half hour afterward a temperature of 104° F, respiration 28, and pulse 124 On March 27, examination of the heart showed that at the apex there was a fairly loud systolic murmur not transmitted, at the base, there was also a systolic murmur, probably hæmic The temperature ranged from 99 to 102° between the first and second transfusions At this time the patient's hæmoglobin was 10 per cent, red cells 900,000, and her condition extremely bad Her weight was 89 pounds She was transferred to Surgical Service A donor for transfusion was obtained and extremely careful tests were made between his blood and that of the patient On March 31 transfusion was performed by Dr Pool by

SPLENECTOMY FOR BANTI'S DISEASE

Date	Red blood-cells	Hæmoglobin	Monoblasts	Megaloblasts	White blood-cells	Polymorphonuclears	Lymphocytes	Basophilic leucocytes	Eosinophiles	Polychromatophilla	Achromia	Pœcilocytosis	Amiocytosis	Remarks
February 4, 1914	1,600,000	p ct 28	0	0	1,900	p ct 75	p ct 21	0	p ct 4	Slight	++	++	++	After first transfusion Wassermann negative Blood for urobilin negative Several large gastric hemorrhages
February 25, 1914	2,260,000	29	0	0	3,800	73	27	0	0	Slight	++	++	++	
March 9, 1914		20												
March 12, 1914		15												
March 13, 1914	956,000	13	0	0	13,800	88	11	0	1	Marked	++	+	+	Before transfusion After transfusion After splenectomy Urobilin in urine
March 18, 1914		12												
March 31, 1914		10												
March 31, 1914		22												
April 3, 1914	1,600,000	14												Urobilin in urine
April 5, 1914	1,200,000	15	3,850	130	9,300	84	16	0	0	++	+	+	+	
April 7, 1914	1,800,000	19	7,400	310	7,700	75	24	1	0	++	+	+	+	
April 13, 1914	1,700,000	19	4,800	2,100	9,100	88	12	0	0	++	+	+	+	
April 14, 1914	1,600,000	20	4,200	930	13,500	88	12	0	0	++	+	+	+	Urobilin in urine.
April 17, 1914	1,700,000	22	6,300	1,400	14,000	79	21	0	0	++	+	+	+	
April 24, 1914	2,000,000	25	2,000	200	10,200	71	29	0	0	++	+	+	+	
May 1, 1914	2,100,000	26	800	110	9,000	62	38	0	0	++	+	+	+	
May 8, 1914	2,100,000	29	1,100	60	5,900	36	61	0	3	++	+	+	+	
			1,300	280	7,000	26	65	0	9	0				

the Lindeman method, about 700 c.c. being transfused. The patient improved considerably and about twenty minutes afterward Dr. Pool removed her spleen.

A vertical incision was made through the left rectus muscle, the upper pole of the spleen was adherent to the diaphragm, and in separating these adhesions a large vein was torn which caused successive hemorrhage. The spleen was rapidly delivered, its pedicle tied off, and the wound closed without drainage. This occupied twenty-two minutes. The patient made an uneventful recovery.

The blood count on several occasions and the pathological report of the specimen are herewith appended.

The pathologist reported that the removed spleen presented lesions essentially those of a chronic interstitial splenitis, typical of Banti's disease.

CURE OF SARCOMA OF THE DORSAL AND LUMBAR VERTEBRÆ UNDER THE TREATMENT WITH THE MIXED TOXINS

DR. WILLIAM B. COLEY presented a man, twenty-one years of age, who after having wrenched his back in the fall of 1898, while wrestling, felt some pain the next 2 or 3 days, which disappeared. A short time later, he again began to feel pain and stiffness in the region of the injury. In December, 1900, he was examined by Dr. V. P. Gibney, who found a small kyphus in the lower dorsal region, and diagnosed the trouble as Pott's disease and had plaster casts applied. The patient's condition steadily grew worse, however, and general weakness developed. In April, 1901, he entered the Montefiore Home for Incurables, he continued to grow steadily worse. In February, 1902, Dr. Coley first saw the patient in consultation with Dr. V. P. Gibney, and quite agreed with him as to the hopelessness of the condition, and stated that nothing more than temporary relief could be expected from the toxins. Physical examination at this time showed a very large tumor of the back, markedly protuberant, occupying the entire region from the eighth dorsal vertebra to the third lumbar, it extended three inches on either side of the vertebral line, and protruded at least three inches beyond the normal surface. The muscles of the thigh and legs were greatly atrophied, there was extreme general emaciation. The patient had lost nearly 60 pounds in weight.

Treatment was begun on February 18, 1902, injecting $\frac{1}{2}$ minim of the mixed toxin of erysipelas and of bacillus prodigiosus into the buttock, the subsequent treatments were given by the members of the house staff of the Montefiore Home, under the direction of Dr.



FIG. 1 —Inoperable round celled (giant-celled) sarcoma of dorsal and lumbar spine (Coley)

Fig 2

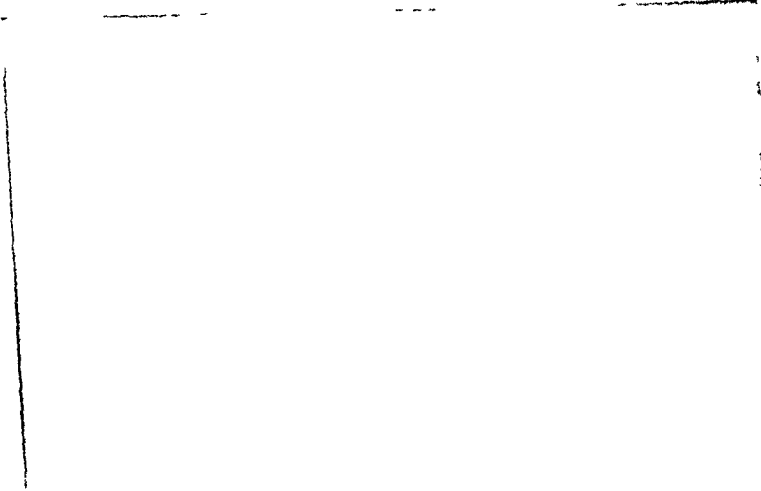
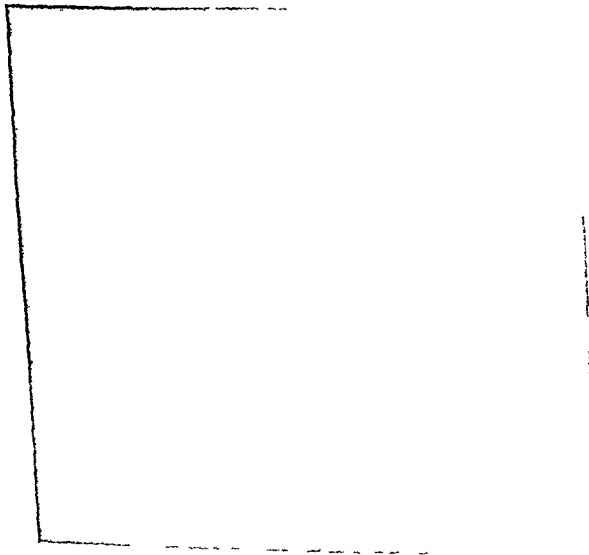


Fig 3

Fig 3



Figs 2 and 3 —Radiographs of spine 12 years after disappearance under toxin treatment of very large inoperable sarcoma of dorsal and lumbar vertebræ

SARCOMA OF DORSAL AND LUMBAR VERTEBRÆ

Wachsmann and Dr. Coley; the dose was increased by $\frac{1}{2}$ minim each day. On February 24, the history states, Dr. Wachsmann thought the tumor seemed somewhat smaller and there was no redness or irritation of the skin. The first chill occurred on February 27, following a dose of 3 minims, the temperature rose to 103.4° , accompanied by pain, nausea and vomiting stained with blood, the pulse was weak and rapid, respiration rapid, blood-stained diarrhœa. The condition was so bad, that the treatment was not resumed until March 6, when 3 minims again caused a temperature of 103.4° accompanied by nausea, vomiting, pain and chills. An interval of 4 days was allowed before the next treatment, a dose of $2\frac{1}{2}$ minims was given, this was followed by a chill and temperature of 103.8° accompanied by chills, the same result followed the administration of 3 minims on March 18 and 20. It was then thought best to give him a short interval of rest. In the meantime, under Dr. Gibney's direction, everything possible was done to stimulate his appetite. On April 2, the treatment was resumed, $1\frac{1}{2}$ minims producing a temperature of 99.2° ; April 3, 2 minims caused a temperature of 100° . On April 7, a dose of 2 minims was followed by a temperature of 99.6° . His susceptibility apparently had increased over that in the first period of treatment, as $2\frac{1}{2}$ minims, given on April 11, caused a temperature of 103.4° ; on April 12, $2\frac{3}{4}$ minims produced 104.2° , on the thirteenth, 3 minims caused 103° , on the fourteenth, following the same dose (3 minims), he had a temperature of 108.8° , showing what I have not infrequently observed—the cumulative action of the toxins following a series of daily doses. In spite of this temperature $2\frac{3}{4}$ minims were given the following day, and followed by only 100° , temperature $2\frac{1}{2}$ minims given on April 16 caused a temperature of 100° , same dose on the seventeenth, 103.6° temperature, with severe chills and lumbar pain.

The treatment was continued with intervals of 1–3 days' rest, up to May 15. At no time did the patient develop the tolerance to the toxins, which is usually observed when the injections are given for a prolonged period in gradually increased doses. The last dose given on May 15 ($2\frac{1}{2}$ minims), was still able to produce a temperature of 104.6° , with severe chills.

Evidently by this time the tumor had become broken down and necrotic, because from then on until June 5—without any toxins—the patient had a daily rise of temperature, often as high as 104° , due undoubtedly to the absorption of broken-down tumor products. In the meantime, the tumor had shown a steady diminution in size, and by June 5 the improvement was so marked that it was thought inadvisable to give

further treatments By the end of September, 1902, the total paralysis had become replaced by fair motor power and ability to walk, reflexes had again reached their normal condition, and the area of sensory disturbances had diminished in extent and intensity There was still some retention of urine, and some constipation Dr Gibney applied a plaster jacket which the patient wore for a number of months; improvement went on until early in 1903 when he had entirely recovered and the plaster jacket was discontinued He resumed his regular occupation and has been working ever since

This patient was presented before the New York Surgical Society three or four years after his recovery, but he moved to a Western state and was lost sight of until August 10, 1912, when he reported by letter that he had been in excellent health the entire time, was married, and had two children He has now returned to New York. He weighs 146 pounds, more than he has ever weighed, and is able to do any kind of work, the X-ray photograph taken May 16, 1914, is of great interest

Report of X-ray Examination (May 16, 1914)—Examination shows between the twelfth dorsal and third lumbar vertebra, there is now a bony outgrowth extending at least 1 inch on both sides of the spine and posteriorly about 1 inch to a plane corresponding to the ends of the spinous processes On the lateral view there is absence of the body of the first lumbar vertebra, *i e*, a kyphosis

The condition is more that of a constructive lesion than a destructive lesion The X-ray appearance is consistent with a new growth in which the process has ended in a deposit of bone in a soft destructive tumor, rather than that of a bony tumor from the beginning (Byron C Darling)

A case very similar to this has recently been successfully treated with the toxins at the Massachusetts General Hospital, by Dr Harmer, in the service of Dr Charles A Porter The case will later be reported in full

PROLAPSE OF RECTUM—MOSCHCOWITZ OPERATION

DR H H LYLE presented a woman, aged fifty-four years, who was admitted to St Luke's Hospital with the diagnosis of prolapse of the rectum In 1906, at Buenos Ayres, she had undergone a right salpingo-oophorectomy, later, a complete hysterectomy at a sister institution in this city On the second day she was gotten out of bed, and "her remarkable cure" was ascribed to the fact of her early rising On admission to St Luke's the patient's general and local condition was deplorable The rectum projected for a distance of 4 to 5 inches, the surrounding skin was excoriated and the site of a

TROPHIC AND CIRCULATORY DISTURBANCES

"weeping eczema" The patient was put to bed and soothing local applications were applied to relieve the distress After ten days the abdomen was opened and the prolapse corrected by the Moschcowitz method. Some difficulty was experienced in closing the anterior portion of the cul-de-sac of Douglas The removal of all the pelvic organs had left a large space and the numerous adhesions from the former laparotomies had rendered the peritoneum less movable To overcome this the stumps of the round ligaments were freed and attached to the anterior aspect of the rectum and to one another The patient made an uneventful recovery, and since leaving the hospital has performed hard physical work. The interesting point is the success of Moschcowitz's method under very unfavorable conditions, a wide pelvis with no uterus or vaginal support to aid, and a peritoneum that had lost much of its pliability through former operations and inflammations. In this case the stumps of the round ligaments were found and used to supply a peritoneal covering to aid in closing the anterior aspect of the cul-de-sac of Douglas

TROPHIC AND CIRCULATORY DISTURBANCES OF THE EXTREMITIES

DR. WILLY MEYER presented a number of patients illustrating trophoneurotic and circulatory disturbances of the extremities

CASE I—This was a man of fifty-seven years, with a Charcot's hip; this in the hip-joint was rather a rare disease He showed all the typical signs of cord affection consecutive to specific infection, the joint had entered a rather acute stage after his having carried a heavy weight When he entered the hospital, the region of the hip was very much swollen, pronounced crepitation was present The X-ray showed the head worn off to a great extent and the capsule covered with irregular vegetations There was no pain whatever, no limitation of motion, as was usually found in cases of this kind The patient had been warned against heavy lifting in order to avoid fracture and had also been advised to wear a mechanical support should the trouble increase

Dr. Meyer next presented a number of younger patients treated with subcutaneous injections of saline or Ringer's solution 4-500, as recommended a year ago by Dr. Koga of Ito's clinic in Kayoto, Japan, and published in the *Deutsche Zeitschrift für Chirurgie*

The first was a young man of thirty, with neuropathic gangrene of two toes, due to syringomyelia of the dorsocervical region, there was no syphilis nor diabetes and a splendid pulse in both anterior and posterior tibial arteries Nevertheless, he had developed gangrene Examination

tion by Dr Geo W Jacoby, the neurologist of the German Hospital, had established the diagnosis. Inasmuch as one older brother, evidently with the same disease, had died in another hospital, after both extremities had been amputated in various places, hypodermoclysis of Ringer's solution was, as an experiment, tried before resorting to amputation and, strange to say, brought complete relief. The patient was able to work again, sometimes there was a marked cyanosis of the anterior part of the foot. Dr. Meyer did not venture to explain the observation, but stated that he wanted to put the case on record. It almost seemed that in addition to the neuropathic affection, there had existed a condition of the blood which was markedly improved by the treatment.

Three further cases were shown, all being young people with endarteritis. One, who had gangrene of the big toe and first metatarsal bone, was cured by arteriovenous anastomosis of the femoral vessels done in Scarpa's triangle, according to Whiting. The operation was performed in May, 1913, the wound healed by primary union. The pains at first continued, but were much improved after the removal of the toes and metatarsal bone, which was done nine days after the first operation. It was interesting to see that at that time there was distinct arterial hemorrhage, of course, with spurting, requiring three ligatures. The wound healed very slowly, the scar broke down at times in small areas. The patient was without pain and able to work, in robust health. If ever the pain should return or the scar should prove to remain obstinate, Dr. Meyer intended to try Ringer's solution. He certainly would have done this before doing the anastomosis, but the article by Koga had not been published at the time of the operation.

One of the two patients shown was a young man who had come to Dr. Meyer's office with this affection, with all four extremities involved. At the left wrist the radial artery and at the right the ulnar were pulsating, but rather feebly. Nine years ago he had an obstinate ulcer of the tendo Achilles which required his staying in the hospital for many weeks. Thiersch's grafting finally cured the trouble. But the pain persisted more or less. He came to the hospital markedly anæmic with pain in all four extremities and a localized gangrene on the radial side of the middle finger. He received 24 hypodermic instillations and was now back at work and without pain. The same good result was shown in another man who had trouble in one extremity.

Arbitrarily Dr. Meyer had decided to make the injections about 24 times, daily or every other day, sometimes only twice a week, according to the patient's sensitiveness, below the clavicle, under the breast and on the outer side of the thighs.

THROMBUS AFTER END-TO-END ANASTOMOSIS

Of course, this treatment will not be successful, probably, in every case; but, as it seemed, it was so in quite a number. One remarkable effect was seen in a patient of forty, at the German Hospital, in whom amputation of one thigh was done years ago, for the same trouble. Now he had come to the hospital with the opposite side affected. He refused to have the thigh amputated, but consented to a Pirogoff, which was done at the end of January. However, gangrene set in again, and it was decided to try the Ito-Koga treatment. The result was that the gangrene was arrested, the man was markedly improved in general health, the pain ceased and he could have a secondary amputation done just above the ankle a few days ago. This would give him the great advantage of a longer stump below the knee.

Dr. Meyer thought that amputation should no longer be advised in these cases as the only possibility. In his opinion it should be the last resort. First he would try the instillation of Ringer's solution; then, if this was not successful, he would do arteriovenous anastomosis and, only if this failed, amputation.

CIRCULATORY AND TROPHIC DISTURBANCES OF THE EXTREMITIES AN ATTEMPT AT CLASSIFICATION

DR. HOWARD D. COLLINS read a paper, with the above title for which see page 742.

THROMBUS AFTER END-TO-END ANASTOMOSIS OF THE POPLITEAL VESSELS

DR. ROBERT T. MORRIS presented a specimen showing a thrombus at the site of an arteriovenous anastomosis. The patient was a man, forty-seven years old, who entered the hospital with thrombo-angitis of the left foot, and gangrene had already involved the little toe. The toe was removed and treatment instituted by giving hypodermoclysis of Ringer's solution. These had the effect of stopping the excruciating pain, and halting the gangrenous process. The wound, however, refused to heal. Dr. Morris then made an end-to-end anastomosis between the popliteal artery and vein. For two days the foot was warm and with normal sensation. On the third day gangrene appeared and on the fourth day the leg was amputated. There had been no sepsis at the seat of operation. The specimens of popliteal vessels removed showed a small thrombus adherent at the suture line. Examination of the amputated leg showed numerous old and new thrombi. Examination of the patient's blood at the time of his entrance to the hospital was negative so far as finding any organisms was concerned.

DUODENAL HEMORRHAGE

DR. FREDERIC KAMMERER showed the specimen of a case of fatal duodenal hemorrhage, for which a gastro-enterostomy had been done and a pyloric exclusion attempted by tying off the stomach with a stout silk ligature, the condition of the patient precluding a von Eiselsberg's exclusion. The history and X-ray findings in this case had rather suggested the presence of some neoplasm in the small intestine than a duodenal ulcer. During the night before operation the patient had a severe intestinal hemorrhage, but his condition the next morning was not serious. At operation an unusually well developed Lane's kink was found, nothing in the small intestine, but a typical duodenal ulcer, situated on the posterior wall, about one inch from the pylorus. An excision was deemed inadvisable on account of the many adhesions. The above-mentioned operations were done, during the course of which it became evident that hemorrhage from the ulcer had ceased temporarily, as the small intestine immediately below the ulcer contained no blood, but further down a blackish-blue discoloration, which extended into the large intestine, clearly indicated the presence of a large amount in that part of the intestinal tract. The patient rallied well from the operation, but 36 hours later he became restless, his pulse ran up to 130-140, his face became blanched. Six hours later, a donor having been found, an attempt was made to do a transfusion, but the patient expired on the operating table. At the autopsy a not very deep ulcer, almost a square inch in size, was found on the posterior wall of the duodenum. The base of this ulcer showed only moderate induration. Exactly at the centre of the same a small opening was easily recognized, from which a drop of blood exuded. This proved to be an erosion in the wall of a branch of the superior pancreatic-duodenal artery, as a probe, introduced at this point, readily passed into the larger vessel. The speaker said this was the second case of fatal hemorrhage from a duodenal ulcer that he had observed during the past year. In the first case the hemorrhage was so severe that an operative procedure was out of question. A study of the specimen presented this evening had left some doubt in the mind of the speaker as to the wisdom of the course he had pursued—at least in this instance. At the autopsy the upper portion of the intestinal tract was also filled with blood, showing that renewed hemorrhage had occurred after gastro-enterostomy and exclusion. The anatomical conditions at the site of the ulcer could, in all probability, have been successfully met by incision of the duodenum and some kind of ligature of the small bleeding point.

TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY

Stated Meeting held May 4, 1914

Dr G. G. Ross in the Chair

UNUNITED FRACTURE OF THE NECK OF THE FEMUR, TREATED BY BONE-TRANSPLANT

DR ASTLEY P. C ASHHURST presented a man, thirty years old, who in August, 1913 (seven months after injury), came under his care at the Orthopædic Hospital, in Dr. Harte's service, and was found to have an ununited fracture of the neck of the right femur. He was unable to walk without crutches, on account of pain and weakness, he could stand alone, and even bear momentarily all his weight on the injured limb, but the hip grated, and the trochanter slid up and down on the pelvis. There was shortening of an inch and three-quarters. A skiagraph showed an ununited fracture at the base of the neck, oblique, and the longer fragment belonging to the head of the bone and the front of the neck (Fig 1).

The patient was referred to the Episcopal Hospital (there being no vacant bed at the Orthopædic Hospital), and admitted to Dr Frazier's service. Operation was done by Dr. Ashhurst on August 22, 1913.

1. An incision was made downward for $3\frac{1}{2}$ inches from the anterior superior spine of the ilium, passing between the sartorius and tensor fasciæ femoris, and then between the ilio-psoas and rectus muscles. The capsule of the hip joint was then opened and detached widely from the anterior intertrochanteric line, exposing the line of fracture, which was bevelled at the expense of the posterior surface of the neck, and extended anteriorly to the extracapsular region of the great trochanter. Only fibrous union was present, and the fragments were easily pried apart with a bone elevator. The fractured surfaces were then freshened. It was now found that by outward rotation, followed by longitudinal traction and finally by inward rotation, the fragments were jammed together in good position. The wound was then temporarily packed with gauze.

2. A bone peg (Fig. 2) was removed from the crest of the left tibia by means of the speaker's circular saw (Fig 3), the dimensions of this peg were four and a half inches long, and one-half by three-eighths by three-eighths of an inch thick (11.5 cm long, and 1.5 cm by 1 cm by 1 cm. thick), it tapered slightly at its lower end. This bone peg was temporarily put in hot salt solution, and the leg wound closed.

3. The fracture of the cervix femoris was set under control of direct vision, by outward rotation, longitudinal traction, and finally inward rotation. While the limb was securely held in this position, an incision one and a half inches long was made over the great trochanter, and by means of a steel drill in a hand-driven brace (Fig 3) a hole was bored through the trochanter and neck into the head. First a drill three-eighths of an inch in diameter was used, then one fifteen-thirty-seconds of an inch in diameter, and as the peg proved too large to be driven in through this hole, a drill half an inch in diameter was finally used. The peg fitted this hole very snugly, and it was necessary to drive it home with very vigorous blows from the mallet (Fig 4). Some of the projecting end of the peg was then cut off. The two wounds in the hip were then closed, and the limb dressed in plaster of Paris from toes to axilla, in an abducted position. The time of the entire operation, including plaster of Paris, was two hours.

September 22, 1913. One month after operation, the plaster case was removed below the knee.

October 12, 1913. Seven weeks after operation the remainder of the plaster case was removed. There was no stiffness or thickening around the hip joint, and the incisions were healed. The end of the bone peg was palpable beneath the skin over the great trochanter. There was no shortening of the limb and no movement between the fractured surfaces. Rotation at the hip was normal. Flexion to 150 degrees was easy and painless. The patient was to stay in bed two weeks longer.

October 20, 1913. Allowed to be up in wheel-chair.

October 25, 1913. Walking with crutches and a high shoe on the left foot, preventing any weight-bearing on the fractured limb.

November 27, 1913. Discharged from the ward, with directions to bear no weight on the right foot until six months after operation. A skiagraph made about this date showed the same conditions as Fig 4. Figs 5 and 6 are from photographs made December 1, 1913, four months and a half after operation.

Soon after this time the patient returned to his home in Ohio. About the first of the year (over four months after operation) he was



FIG 1 —Ununited fracture of cervix femoris seven months after injury Unable to walk without crutches



FIG 2 —Showing defect in tibia after removal of bore peg

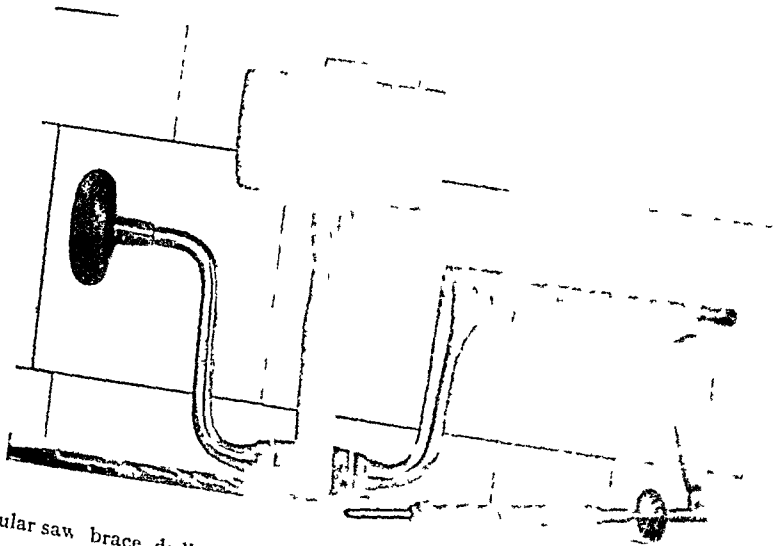


FIG 3 —Circular saw brace drills and mallet used in transplanting a bone peg for ununited fracture of neck of femur

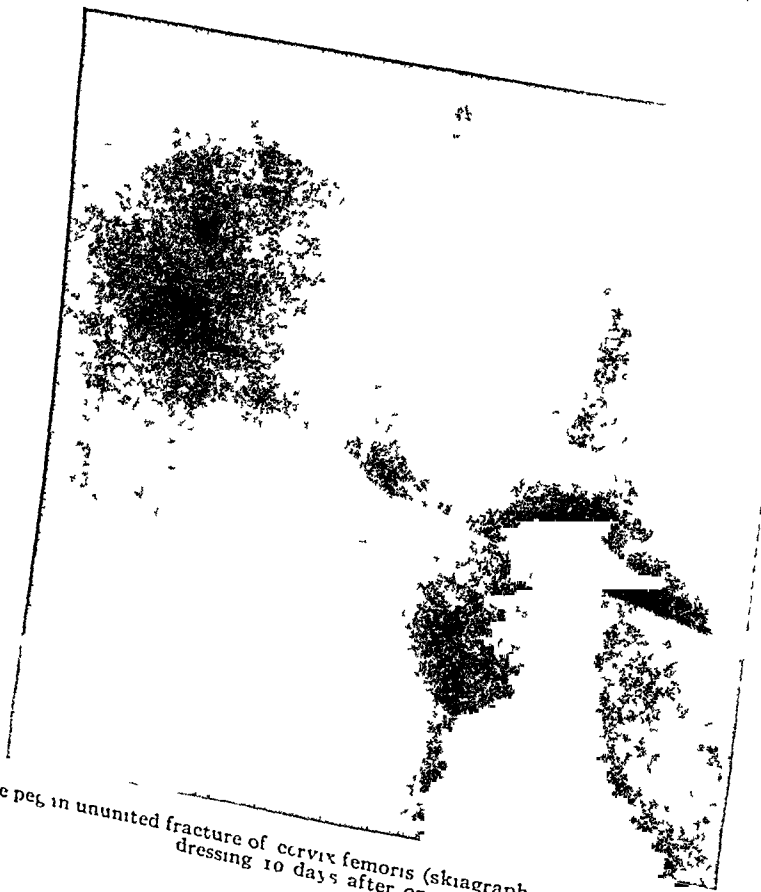


FIG 4 —Bone peg in ununited fracture of cervix femoris (skiagraph made through plaster-of-Paris dressing 10 days after operation)

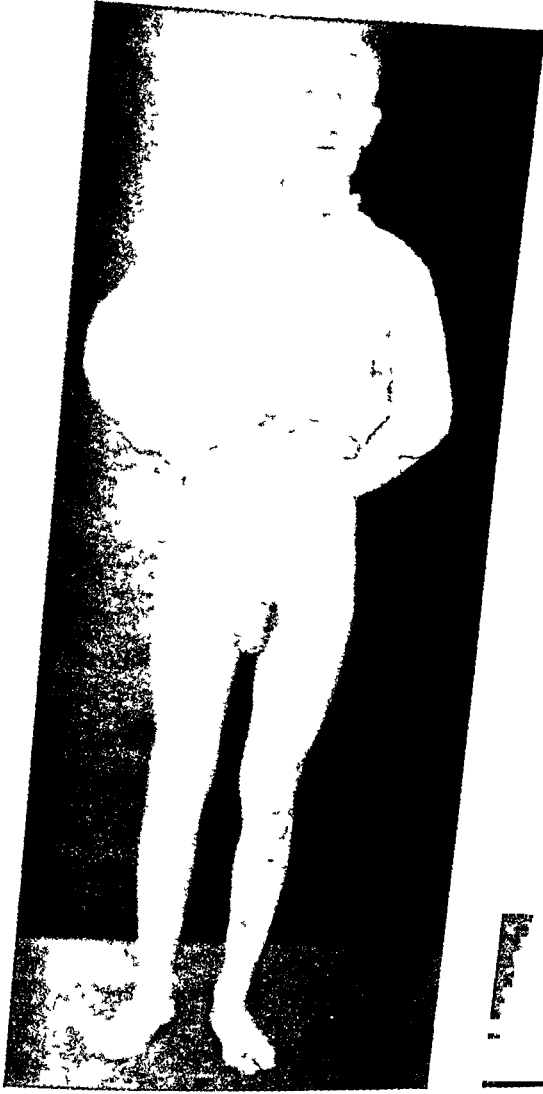


FIG 6



FIGS 5 and 6 — Bone peg implanted in neck of femur for ununited fracture motions, four months and a half after operation No shortening free

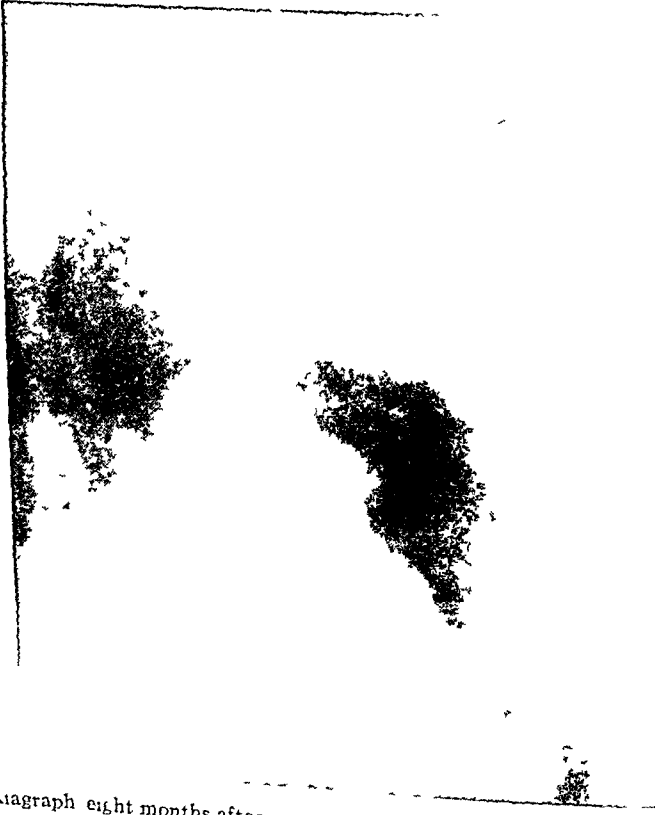


FIG 7 —Skiagraph eight months after insertion of bone transplant, showing incomplete fracture of the transplant and secondary consolidation

permitted to abandon the use of the high shoe, but was directed to continue the use of crutches. This, however, he did not do. He felt so well and strong, he wrote, that as soon as he gave up using the high shoe he threw away his crutches. The effect of this was apparent when he next presented himself for observation on April 20, 1914. He was now wearing a lift in his right heel, as he felt the limb was shorter than the left. Measurements showed a shortening of half an inch, in December, 1913, there had been no shortening. Otherwise the hip was in good shape: there was flexion to about 70 degrees, free rotation, abduction through about 10 degrees, and all these motions were painless. Walking was easy without any support, but there was a noticeable limp, the man had not been able to return to his usual occupation in the pottery, as this involved heavy lifting, and his employers were unwilling to risk an accident though the man himself said he was sure he could do the work. Meanwhile he had been doing odd jobs, but he had no steady employment. His chief complaint was of pain above the knee, worse after resting. When his knee gets limbered up he walks with very little limp.

A skiagraph was taken (Fig 7), and this promptly revealed the cause of the shortening, the transplant had fractured, and the resulting coxa vara prevented as free abduction as had been present before the patient resumed weight-bearing on the limb. In spite of the fracture of the transplant, the fragments seemed to be firmly united, though little callus is visible in the skiagraph. It is interesting to see that the end of the bone peg projecting beyond the trochanter is gradually being absorbed. In Albee's similar case, of which an illustration is given in Murphy's Clinics (June, 1913, Fig 98), it is stated that the skiagraph (five weeks after operation) shows proliferation of bone from the protruding end of the bone peg. In the skiagraph of the present patient there is apparent quite a growth of bone on the surface of the femur around the drill hole, but this, I believe, is due to extension from the femoral shaft and not due to growth in the transplant. Dr Albee always preserves the periosteum in his transplants, and Dr Murphy does likewise, but in Dr Ashhurst's operations he has always removed the transplant subperiosteally, regarding the periosteum simply as a limiting membrane. McWilliams, however (*Jour Amer Med. Assoc.*, 1914, i, 346), has reported very careful experiments, in which he comes to the conclusion that it is very important to preserve the periosteum because it renders the transplant more easily permeable by surrounding capillaries, thus ensuring the early establishment of an adequate circulation through it. His experiments certainly show the

value of preserving the periosteum, since in a number of instances he secured reproduction of bone from periosteum alone, but there may be another reason than that given by Dr McWilliams for the greater liability of the bone graft to be absorbed when it is uncovered by periosteum. This may very well be that the periosteum really acts only as a limiting membrane, and *protects the transplant from solution by the cells of the surrounding tissues*. When the transplant is *embedded within osseous tissue*, as is the case in the transplant figured in the accompanying illustrations, and in the transplants used for splinting the tuberculous spine, there is apparently little fear of its absorption; when, on the other hand, it is embedded, not in osseous tissue but in the soft tissues, it is very likely to be absorbed unless protected from solution by an envelope of periosteum, its *normal limiting membrane*. Thus it is not surprising to see in Fig 7 that the end of the bone peg projecting beyond the femur is being absorbed, while that embedded within bone, or in immediate contact with living bone, preserves its form unaltered. It will be interesting to know what became of the end of Albee's transplant eight months or more after operation. J B Murphy has reported one case (Murphy's Clinics, October, 1913, vol 11, p 797) in which he thought the preservation of the periosteum was detrimental to the production of new bone, but unfortunately the stenographic report of his remarks is so inaccurate that it is impossible to know just what was done. The skiagraphs he presents indicate that a subperiosteal resection of the upper end of the humerus was done for cystic osteitis, and that in the place of the diseased humerus (removed subperiosteally) a transplant was inserted which had its own periosteum still in place. The subsequent skiagraphs (Figs 200-204) indicate that the transplant with its periosteum was then surrounded by new bone formed between the transplant and the ensheathing periosteum which belonged to the excised humerus, and Dr Murphy states that the periosteum which belonged to the transplant acted detrimentally in that even as long as seven months after operation it remained as a white line (visible in the skiagraph) between the transplant and the surrounding new-formed bone. But though all the skiagraphs clearly indicate that this new-formed surrounding bone developed beneath the original periosteum of the (subperiosteally) excised humerus, it is stated in the text of Murphy's Clinics (p 788) that the periosteum was excised along with the diseased humerus.

Although the patient presented has been walking on his leg without any support from crutch or cane for a period of four months, it is scarcely possible to reckon his present condition as an end-result

UNUNITED FRACTURE OF NECK OF THE FEMUR

He has not returned yet to his ordinary work, but there seems every likelihood of his being able to do so within a short time

Finally, Dr. Ashhurst suggested that bone transplantation is a better method of treating ununited fractures of the hip than the use of nails, screws, etc. But, as the present case demonstrated, it is not safe for the patient to bear weight on the limb as soon as four and a half months after operation. This patient did so contrary to advice, and as a consequence he fractured the transplant.

In an interesting paper on the subject of intracapsular fractures of the hip, read before this Academy two years ago by Dr. G. G. Davis (*Trans Phila Acad of Surg.*, 1913, xv, 112), the following were among the conclusions reached:

"The surest way of remedying cases of ununited fracture of the neck of the femur is to cut down, freshen the edges of the fragments, pin them together with screws, nails, or other means, and put them up in the abducted position. When foreign bodies are inserted to pin the fragments together they are likely to cause discomfort sufficient to necessitate their removal. Considerable discomfort follows the operation and the patient is inclined to attribute this to the nail or screw and demand its removal. Firm union can be obtained by freshening the surfaces of the fragments and then jamming them together by widely abducting the limb and fixing it in plaster of Paris without the use of any nails, screws, or other fixation appliances."

These conclusions of Dr. Davis, who has had more experience than any other Fellow of the Academy with operations for ununited fractures of the hip, were reached before the operation of bone transplantation came into general use, and it seems that this is a better method of fixation than the use of foreign material such as nails, screws, or even ivory pegs, and that some form of direct fixation of the fragments is extremely desirable, though it had been shown by Dr. Davis that in some cases it was possible to secure firm bony union without direct fixation.

DR. J. T. RUGH said that last fall he made bone-grafting for ununited fracture of the neck of the femur in the case of a woman forty-three years of age, who had suffered a fracture two years before. Two years ago, he put in a silver wire nail, which remained in place until the second operation. At the time that he put in the nail, after freshening the edges, he was surprised at the softness of the bone in the upper end of the femur. The nail was driven in with the greatest possible ease, so that the bone was evidently partially degenerated, and at the end of two years while the nail was in place, there was no attempt at union. She could walk slightly on the part, but a slight upward dislocation had

SUBLUXATION OF ULNA

CINEMATOPLASTIC AMPUTATIONS

DR. A. P. C. ASHHURST presented a brief paper, with this title, for which see page 750

DR. GWILYM G. DAVIS remarked that it seemed to him that there was a field for this type of amputation and he thought that surgeons would be more careful in the way that they do amputations and operate more from the utilitarian standpoint. For instance, in the lower extremity the adaptation of an artificial limb is often interfered with by the lateral protrusion of the bones in the knee-joint and ankle-joint. If such a person wishes an artificial appliance around the foot, anything placed over this protrusion increases the width of the ankle so much that it gives the impression of a marked deformity, which is of course very objectionable. That can be obviated by making the section above the ankle and getting rid of the swell of the ankle, so that when one adds the apparatus in addition to the natural stump it makes a diameter equal to the normal ankle. The operation suggested by Dr. Ashhurst is along the same lines. It is interesting that in these particular cases the biceps was united to the triceps. The biceps flexes and the triceps extends. Look at the field this opens. All we have to do is to divide the arm laterally and lift the triceps posteriorly and the biceps anteriorly, make a sling on each of them, and then when the attempts to contract are made the patient can contract either one and you have a double action of the muscles. This suggests the question as to how the patient must think to produce a contraction of the loop. One might expect the muscles to act irregularly, and to make them work regularly will require special training of the cerebrum.

When we come to the question of transplanting muscles of the knee, where you take the hamstring muscles, which are flexor muscles, and bring one of these forward to the patella and make it an extensor muscle, then when the patient contracts the muscles it simply stiffens the limb without giving any special direction, and that works very well. But he was not convinced that it has been definitely demonstrated that we can, within a reasonable time, take a flexor muscle and deliberately sandwich it in among the extensor muscles and expect it to act contrary to its original method.

RETENTION CYSTS OF THE PANCREAS

DR. JOHN SPEESE read a paper with the above title, for which see page 673

SUBLUXATION OF ULNA

DR. JOHN H. JOPSON showed a case of subluxation of the lower end of the ulna in a girl aged fifteen with the following history. Eighteen

PHILADELPHIA ACADEMY OF SURGERY

months before he first saw her she had fallen and fractured her right wrist and was told, after an X-ray examination, that the wrist was broken in two places. She wore splints for six weeks. She has had more or less trouble with the wrist since that time, and more especially since she went to work in a cigar factory two months ago. Since that time there has been noted considerable pain and deformity. Examination of the wrist showed a deviation of the hand towards the radial side. There was no silver fork deformity. In pronation the normal prominence of the head of the ulna was present and even somewhat exaggerated on the back of the wrist (Fig 8). On supination a well-marked subluxation of the lower end of the ulna forward was noted, and the articular surface could be readily palpated on the front of the wrist (Fig 9). In this position of the hand there was a marked groove between the dorsal surfaces of the bones, and the sigmoid cavity of the radius could be palpated on the back of the wrist. Reduction and re-dislocation occurred with each motion of pronation and supination respectively, and these movements were painful. The X-ray showed an old Colles fracture of the wrist in good position, about half an inch above the end of the bone. There was an unhealed fracture of the styloid process of the ulna. The fracture of the radius had apparently resulted in shortening due to impaction. The ulna seemed longer than its neighboring bone, although this did not show prominently in the X-ray.

The operative problem seemed to be to shorten the ulna, to fix the bones in their normal relation by re-attaching the styloid process and with it the triangular cartilage in their normal positions, and to secure additional fixation by suture of the ends of the radius and ulna to each other. The following operation was performed. An incision about three inches long was made on the dorsal surface of the ulna, parallel with, and near its radial border. The posterior ligament of the wrist was severed and retracted, exposing the head of the ulna, the periosteum was elevated, and the end of the bone with its articular surface resected for about 1 cm. The edges of the sawed surface were rounded and a small hole drilled through the outer border. The periosteal covering of the adjacent borders of the radius and ulna was exposed and several sutures were passed, fastening the two bones together where they were in contact. Another suture was passed through the triangular cartilage and around the fractured styloid process, and through the hole which had been drilled in the head of the ulna. When this was tied the styloid process was brought in contact with the resected end of the bone. The posterior ligament was reunited and the wound closed.

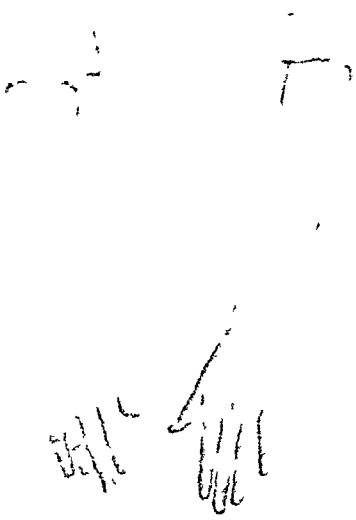


FIG 8 —Subluxation of the ulna

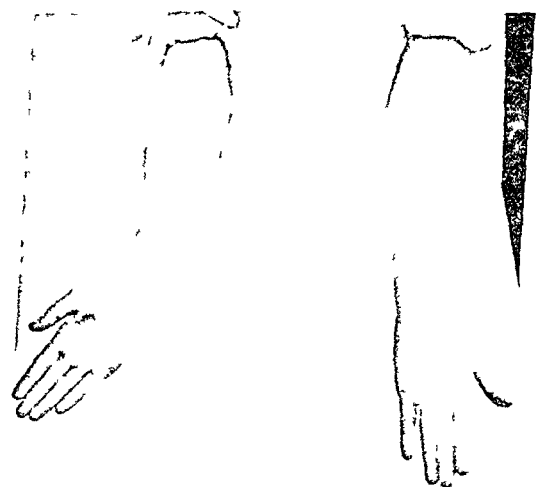


FIG 9 —Subluxation of the ulna

SUBLUXATION OF ULNA

Both silk and chromic catgut sutures were used. The arm was dressed in pronation on a palmar splint. The wound healed by primary union, but a small aseptic abscess developed as the result of irritation from one of the silk sutures, and a sinus remained for several months until the silk suture had separated and could be removed, when it promptly closed.

The result has been most gratifying. The patient shows perfect restoration of the movements of the wrist, supination and pronation being practically complete, with no tendency to a return of the luxation, and she is again working at her trade of cigar maker. She says that the wrist hurts her sometimes, especially in damp weather. The hand and forearm seem nearly as strong as normal.

Dr. Jopson further remarked that in the Transactions of the New York Surgical Society (ANNALS OF SURGERY, June, 1913) is the report of a case presented by Dr. William Darrach under the title of "Habitual Forward Dislocation of the Head of the Ulna," in which the symptoms were almost precisely the same as those which this patient exhibited. In Darrach's case the condition followed a series of injuries to a chauffeur, the radius being twice fractured by the back kick of an automobile, and fracture of the styloid process of the ulna being associated with it. The third injury, in which the wrist had been injured but not fractured, had resulted in this type of subluxation. The head of the ulna slipped out on supination and returned to its normal position on pronation. There was increased antero-posterior mobility at all times, and an X-ray showed the ulnar styloid to be still ununited, and a backward curve of the radius was present due to imperfect reduction of the fracture.

As Darrach remarked, luxations of the lower end of the ulna which are not associated with fracture of the radius are rare, there being 33 reported cases. With fracture of the radius the condition is much more common. He points out that even when the accident of dislocation has been recognized and reduction completed, a weakness at this joint may remain due to imperfect repair of the structures on which the strength of the joint depends, namely, the triangular ligament and the joint capsule. This is especially prone to be the case if the ulnar styloid is broken, as the attachment of the triangular cartilage to its base favors tearing loose of this important structure, which holds the ends of the radius and ulna together. Darrach could find only six cases of habitual dislocation of this joint: 3 reported by Hoffa and 3 by Courtin. He did not find the impairment of function in this case sufficient to call for operation at the time, but stated that if sufficient disability should re-

second pregnancy In July, 1911, one month before her child was born, she first noticed a small swelling below the angle of the jaw on the right side of the neck This gave her practically no pain and has increased slowly in size At the present time the patient presents herself with a hard, painless, movable ovoid swelling about the size of a pigeon's egg in the right upper cervical region, which resembles a tuberculous lymph gland There is a small white scar below it near the anterior border of the sterno-cleido-mastoid muscle which has been present since childhood, and probably represents the scar of an old abscess The diagnosis was tuberculous lymph adenitis

Operation, March 19, 1913 Oblique incision in crease of neck over tumor Removal by dissection of the solid tumor was accomplished without great difficulty, except at its anterior inferior border, where it was densely adherent, and could not be separated from the external carotid artery until that vessel had been doubly ligated and divided The gland lay in the bifurcation of the common carotid artery adherent to, and apparently compressing, the external carotid which was smaller than usual probably as the result of pressure, and was not identified as the external carotid until it had been ligated The wound was closed and primary healing occurred, the patient being discharged cured at the expiration of eleven days The tumor was sent to the laboratory of the Polyclinic Hospital for examination, and the following report was returned

Specimen was received in the laboratory in 4 per cent formalin The mass is roughly ovoid in shape, well encapsulated, quite firm and somewhat elastic, roughly nodular and greyish-white in color The cut surface is smooth, white, homogeneous and even in texture

Microscopical Examination—Sections present a well-defined capsule with irregular bands of connective tissue extending into the depth of the tumor (see Fig 10) These bands divide and subdivide, forming an alveolar structure The connective-tissue cells of these septa are, as a rule, long spindle-shaped cells, well defined and with mature oval nuclei Scattered about are groups of younger connective-tissue cells with oval and slightly vesicular nuclei Portions of the tumor show well-defined alveolar arrangement, but in most areas the structure is more diffuse In the alveolar portions the cells are irregularly grouped, well defined, polyhedral or round, with round or oval, sharply defined nuclei The protoplasm of these cells is quite homogeneous with poorly defined partitions between individual cells The size of these cells varies, and evidences of mitoses are present In a few places the alveoli appeared to be grouped about or are intimately related to blood spaces with several layers of polyhedral cells grouped about the layer of intimal cells The vascular supply of the tumor is not especially abundant The blood-vessels are not well defined, and the walls are thin

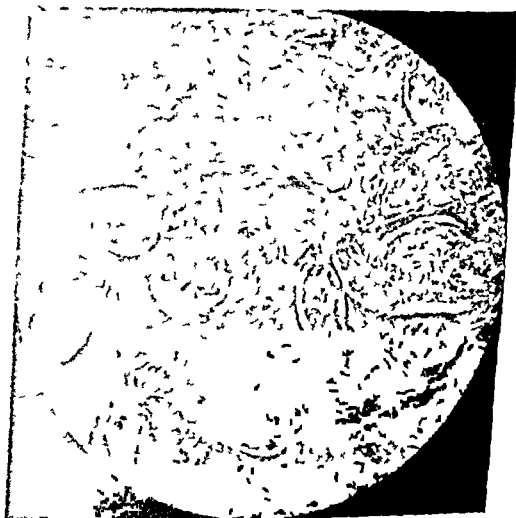


FIG 10 —Tumor of the carotid body

sult he would resect the lower inch of the ulna. In order to repair the damage completely he stated it would be necessary to obtain union between the ulnar head and styloid, and to reef the capsule, and also to overcome the backward bending of the radius with the resulting strain on the anterior portion of the joint capsule.

It is a well-recognized fact that dislocations, partial and complete, of the lower end of the ulna are frequent complications of Colles fracture, especially when associated with fracture of the styloid process of the ulna, and numerous clinical and experimental observations by Pilcher, Moore and others have made clear the anatomical reasons for this association. A persistent recurring subluxation of the type described by Courtin, Hoffa and Darrach, and a typical example of which is that here reported, is due to imperfect repair of the injured parts, especially of the fractured styloid, or to persistent strain on the joint due to imperfect reduction of the fractured radius, or to permanent shortening of that bone as a result of crushing and impaction. It may also accompany fracture of the forearm in its upper portion as in a case of Hamilton's referred to by Courtin, or fracture of the middle third of the radius, as in one of Hoffa's cases, or even certain forms of violence unaccompanied by fracture, or at least in which no fracture has been demonstrated, as from the lifting of a heavy weight, or where a child is violently lifted by pulling on its hand. The last-mentioned cause is emphasized by Tillmanns as one of the commonest etiological factors in subluxations, and while repair in these cases is usually complete and permanent, recurring subluxation may follow, as in one of Courtin's cases. Tillmanns also emphasizes the difficulty of retaining in place the end of the ulna in those complete dislocations in which fracture of the radius is an associated injury. That recurring subluxations and luxations of the radio-ulnar joint are not more frequently noted is probably because they are not looked for, and also because they do not necessarily impair the strength and usefulness of the joint. We have seen another typical example of subluxation of the ulna only recently in an elderly woman, who had sustained three fractures of the left forearm at various periods of her life, one of the fractures being a typical Colles for which we had treated her, and, aside from the deformity, the patient presented no symptoms. There was an associated fracture of the styloid of the ulna. On the other hand, some of the weak and painful wrists observed after Colles fracture are probably due to this condition, and it is an interesting fact that so many of the systematic works on fractures omit any mention of it, as Darrach has pointed out.

TUMOR OF CAROTID BODY

and often present only the endothelial lining. In many areas the typical chromaffin cells of the carotid gland are to be seen, and, since the normal structure of the gland is so disturbed by the new tumor tissue, these have aided in establishing the relation of the tumor to this gland.

Diagnosis—Endothelioma or perithelioma of the carotid gland.

It will be seen that this case resembled, in its clinical course and operative finding, a number of the reported cases of tumor of the inter-carotid gland, or carotid body. The number of cases on record is rapidly increasing as the attention of surgeons and pathologists is directed to the subject. Keen and Funke in 1906 published the first careful study of the subject in America, collecting 29 cases. The recent articles by Callison and Mackenty (*ANNALS OF SURGERY*, December, 1913) and Balfour and Wildner (*Surgery, Gynecology and Obstetrics*, February, 1914) are quite exhaustive studies of the subject from the clinical and pathological standpoints. Callison and Mackenty brought the statistics up to date by collecting 31 cases in addition to Keen and Funke's series of 29, making 60 in all, and to these may be added the case reported in Balfour and Wildner's study of the anatomical and histo-pathological side of the subject, and our own case. Other cases are probably also already on record.

To reiterate the salient points of this case it will be noted that, as in the large majority of cases of this affection, the diagnosis of carotid tumor was not made before operation, nor, indeed, until the pathological report had been returned. This has been the common history in these cases. The tumor was, of course, solitary, of slow growth, of moderate size, and gave rise to no symptoms except a slight disfigurement. This is also the usual clinical history until the tumor reaches a stage where it takes on rapid growth and assumes a more or less malignant nature, when recurrences, metastases and involvement of the neighboring cranial and sympathetic nerves may be excited. At operation the tumor was so closely adherent to the external carotid that that vessel was doubly ligated and divided before it could be removed. Fortunately, the tumor had not advanced to the left, where it surrounds the vessels and renders ligation of the three carotids necessary to its removal. Of 54 operated cases the external carotid was ligated singly in 7 instances, and the three carotids in 32 cases. With the necessity of triple ligation, the mortality and complications from embolical softening, secondary hemorrhage and injury to neighboring nerves increases very rapidly, and the death-rate reaches the proportions in all operated cases of 22 per cent (12 deaths in 54, according to Callison and Mackenty's statistics).

The pathological report in this case was endothelioma or peri-

thelioma These are the usual pathological findings. One case was reported as carcinoma The demonstration of chromaffin cells by Kolmer clinched the pathological diagnosis of carotid tumor in our case

PARTIAL COLECTOMY FOR INTESTINAL STASIS

DR JOHN H JOPSON reported the case of a woman, aged thirty-four, who had been ill since November, 1911 Her symptoms were those of intestinal stasis, obstinate constipation, abdominal pain aggravated by eating, eructations, great loss of weight and quite marked neurasthenic symptoms When first seen she was of a tall, thin, gastropototic type of female, but this was largely due to the fact that she had lost 30 or 40 pounds within a few months She had a marked secondary anæmia In May, 1912, Dr Jopson had removed her appendix which showed chronic interstitial changes, and separated numerous broad, thin adhesions between the first portion of the duodenum and the transverse colon which were causing a moderate obstruction of the first-mentioned portion of the bowel The stomach showed no disease She was not in the least improved by this operation, but continued with the attacks of gastric pain, gas, inability to take anything in the line of solid diet, and with some hyperacidity The constipation became much more obstinate. Inflation of the stomach showed a very moderate ptosis

The patient was placed on a modified rest cure in the hospital, but vomiting, abdominal pain and distress, and eructations continued.

In August, 1913, the abdomen was reopened Careful examination showed that adhesions which were divided fifteen months previously had not reformed, the large bowel being remarkably free, except at the hepatic flexure of the transverse colon At this point the bowel was acutely kinked, the ascending colon and transverse colon were bound together by adhesions of the same avascular nature as those discerned at the first operation The ascending colon was much distended The distal portion of the transverse colon and the descending colon were moderately collapsed, and there were a very few adhesions at the splenic flexure, which were divided

The terminal portion of the ileum was divided and the cæcum and ascending colon and hepatic flexure and the first portion of the transverse colon were excised A lateral anastomosis was performed between the terminal portion of the ileum and the transverse colon beyond the point of its division

The patient made a good operative recovery, and when seen four months after operation she was greatly improved She had gained about 16 pounds in weight Her constipation was entirely relieved

The stomach symptoms, indigestion, eructations, etc., were very much less and improvement was still progressing. She could eat a normal meal, at least once a day, and, while she still complained of some lumbar pain, especially marked on the right side, which she had had for several years and which was associated with a very movable kidney on this side, she was, comparatively speaking, a well woman in contrast to her condition before the first and second operations. Since then she has not been ill enough to consult her physician, although he recently heard from her to the effect that she was again having some gastric indigestion, mucus in the stools, and some of her old symptoms, so that the final result of the operation cannot yet be stated.

CYSTIC LYMPHANGIOMA OF THE GREAT OMENTUM

DR. GEORGE W. OUTERBRIDGE (by invitation) read a paper with the above title, for which see page 680.

DR. J. STEWART RODMAN said that the case to which Dr. Outerbridge referred was one which occurred in his father's clinic and was reported in 1909. The diagnosis was presumably an ovarian cyst of enormous dimensions in a girl of seventeen, and at operation this cystic tumor seemed to fill the entire abdominal cavity, even after opening the abdomen it was still considered an ovarian cyst, but after evacuating the contents of the unilocular cyst it was seen that it did not originate in the pelvis but in the upper abdomen, and, finally, its origin was found to be between the layers of the great omentum, from which it shelled out rather easily. The patient made an uneventful recovery.

DR. P. G. SKILLERN, JR., remarked that there is a type of congenital mesenteric cyst that arises from anlage of tubules of the Wolffian body, which become sequestered between the layers of the mesentery. An example of this type was reported by Dr. H. C. Deaver in the *ANNALS OF SURGERY* for May, 1909, page 619. It occurred in a seven-year-old school-girl, in whom symptoms of intestinal obstruction presented themselves. At operation three cysts the size of plums and with clear contents were found between the layers of mesentery in relation with the terminal loop of ileum, so embracing it as to cause the obstruction. It was necessary to resect ten inches of the ileum, together with the cysts. A lateral anastomosis was then performed.

In the differential diagnosis, mesenteric cysts are not uncommonly mistaken for ovarian cysts. In avoiding this error, it is helpful to ascertain if the tumor has grown from the abdomen towards the pelvis or *vice versa*, if an inferior zone of resonance can be obtained by the

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Trendelenburg position, and if both ovaries are independent of the tumor

If discovered accidentally, mesenteric cysts should be removed for prophylaxis of intestinal obstruction, and even for malignant degeneration.

There are four ways of dealing with intramesenteric cysts: (1) By aspiration, (2) by cystostomy and drainage, with or without the use of caustics, (3) by enucleation, (4) by resection of the involved intestinal segment. The first is obsolete because followed by recurrence. The second is useful in the presence of numerous adhesions. The third is ideal when practicable. The fourth is useful in the presence of multiple, juxtaposed cysts.

DR ASTLEY P C ASHHURST asked Dr. Outerbridge whether the arcus magnus, corresponding to the free border of the omentum, was present in his case. That the diagnosis of omental cyst is sometimes made clinically is evidenced by this fact. He recalled hearing his father talk about a case at the Pennsylvania Hospital about twenty-five years ago. He said he had not seen the patient, but from what he had heard he had thought it must be a case of omental cyst, and of all the physicians and surgeons who had examined the patient in the hospital, no one but Dr. William Hunt had made the correct diagnosis. This diagnosis was confirmed by operation.

DR GEORGE W OUTERBRIDGE, in closing, answering Dr. Ashhurst's question, said that he could not tell whether in this case there was a blood-vessel running along the free border of the omentum owing to the extensive development of cysts in this region, whereby the relations were largely destroyed. He thought the blood supply of the omentum undoubtedly varied enormously in individual cases, and that the conditions described would probably only be found in an occasional instance.

Regarding Dr. Skillern's statement that omental cysts are closely related to mesenteric cysts in the manner of formation, he would say that most of the true mesenteric cysts are likewise lymphatic in origin. Many of these have chylous contents; a condition not found of course in cysts of the omentum.

PERFORATED ULCERS OF STOMACH AND DUODENUM

DR GEORGE G ROSS said that it has so happened that between November 1, 1913, and the first of April, 1914, he had seen five cases of perforation of the stomach or duodenum, and one case which he believed was a perforation of the stomach on the posterior surface at

PERFORATED ULCERS OF STOMACH AND DUODENUM

the greater curvature. There was, however, considerable doubt as to the correctness of the diagnosis, the case being the one that he reported to the Academy several meetings back.

The first case he reported was seen by him in consultation and was referred to the wards of the German Hospital, being operated upon by Dr. John B. Deaver during his clinic the same afternoon.

CASE I—An adult man

History—Seven or eight years ago had an attack of indigestion which lasted for several weeks. He described this indigestion as follows. a fulness coming on immediately after eating and a feeling that he would be relieved if he could belch, but he could not belch. He was put on milk and toast at that time and some medicine, and after two weeks' treatment regained his normal health, except for constipation which had been the case throughout his life. About three months ago he began to have an uncomfortable feeling of fulness in his stomach, coming on immediately after eating, which was relieved by light diet. He was unable to belch, never vomited, passes considerable flatus. November 14, 1913, he ate a heavy lunch and was very uncomfortable during the afternoon. About 6 30 P M, while sitting at a desk writing, he had a severe attack of epigastric pain, coming on suddenly and radiating up over the chest. He said his pain was constant, not spasmodic, and was made worse by inspiration. There was no nausea, nevertheless he attempted to empty his stomach by putting his fingers down his throat. He said that once last evening he felt like fainting but got to the outside air and averted it. His pain kept up all night, referred to the back of his neck and right shoulder. Drank a glass of warm milk this morning, retained it, and his pain was not exaggerated. Says bowels have been moving with purgatives but has not passed any flatus lately.

When admitted to hospital his eyes were sunken, pupils normal, heart and lungs surgically negative, abdomen distended, general board-like rigidity, liver dulness diminished, point of greatest tenderness midway between umbilicus and xiphoid. peristalsis present, extremities normal.

Operation—By Dr. Deaver. Dorsal position. Iodine preparation. Low right rectus incision. Appendix adherent. Appendectomy. Gas and cloudy serum escaped when the peritoneum was opened. Purulent material appeared when the adhesions about the appendix were broken up. Culture taken. Upper right rectus incision. Gas bubbled out when peritoneum was opened. Perforation of the posterior surface of the duodenum. Duodenum was plicated with double linen. *Gastrohepatic* and *gastrocolic*

omentum stitched over ulcer. Upper abdomen wiped out with gauze. Posterior gastro-enterostomy done in the usual manner. Pelvis mopped out. Glass tube for drainage. Wound closed in layers to drainage. Dry dressing. Uneventful recovery.

This diagnosis was made in this case from the previous personal history, the character of the onset of the attack, the appearance of the man being hard hit, the location of the pain and tenderness, the board-like rigidity and the early appearance of distention, as demonstrated by the diminished liver dulness.

CASE II—Female, aged sixty-eight, was admitted to the Germantown Hospital, January 26, 1914.

History—For about three years she has had attacks of indigestion. These would occur every six or seven weeks and would last three or four days. For the last five months these attacks have been getting more severe and frequent. Recently they have occurred every week. Had a severe attack about one week ago, Monday, January 19. On Thursday following she had to go to bed. On Sunday she suffered intense pain in abdomen with constant vomiting. This continued until Monday morning, January 26, when she had a few hours' respite from vomiting; but in the afternoon the vomiting returned following the ingestion of a cup of broth. Bowels have not moved for seven days. Has always had trouble with her stomach since childhood, having spells of acute indigestion coming on three or four hours after eating, causing vomiting. For the last five or six years she has been unable to have a bowel movement without taking a purgative. She has had four children, all living and well.

When admitted her abdomen was tender, very little distended, visible peristalsis. Knuckles of gut could be seen through the emaciated, relaxed abdominal wall. There was very little audible peristaltic sound. The vomiting ceased upon withdrawal of all food and liquids by mouth. The case did not impress him as one of acute mechanical obstruction of the bowels and so she was not operated upon as an emergency case. His diagnosis was malignant growth of the sigmoid with partial obstruction. For several days she remained the same, excepting the failure to empty the bowels of feces or gas. Her leucocytes were 10,300.

Operation—Long incision. Right rectus muscle. No evidence of peritonitis, localized collection or malignancy in lower abdomen. A knuckle of ileum was found to be adherent to the stomach at the pylorus, and this, having become kinked, had given rise to mechanical obstruction. When the gut was freed from the stomach wall, a perforation of the anterior wall large enough to receive a lead pencil was exposed. There was no pus in the

locality and very little lymph. The perforation was closed by purse-string suture, oversewn with Lembert sutures of linen thread, and reinforced by a graft of gastrocolic omentum. Wound was close without drainage, gastro-enterostomy was not performed. Patient made an uninterrupted recovery and was discharged, 31 days after admission.

Dr. Ross said that he was unable to make a diagnosis in this case because he did not properly credit the previous history of stomach indigestion. She had stated that she had had trouble with her stomach since the age of 7, a period of 61 years. The pain of her perforation has occurred 8 days prior to her admission and all her symptoms at that time indicated a partial intestinal obstruction without marked toxæmia.

CASE III.—Adult, female, admitted to the Germantown Hospital, February 11, 1914.

History—Was seized 48 hours before with intense pain in the upper abdomen. She described this pain as resembling a knife going through her stomach. The pain came on about five o'clock in the afternoon, after she had eaten her dinner. The patient states that during the day she had worked very hard. She was treated outside from Monday night until Wednesday afternoon, when she was admitted to the hospital. She stated that for the last 10 years she has been having pain after eating. This would come on immediately after the taking of food. She would belch sour material and would frequently vomit, vomiting relieved pain. Was admitted to this hospital in the Spring of 1913 and operated on for uterine fibroids. Following this operation the patient's symptoms were not relieved. No history of gastric ulcer in family. The abdomen was markedly distended, with rigidity and marked tenderness. The rigidity and tenderness were most marked in the epigastrium.

The abdomen was opened in the midline, from the ensiform cartilage to the umbilicus. A large subdiaphragmatic collection containing pus, lymph and stomach contents was opened. The collection was to the left of the suspensory ligament of the liver. When this was cleaned out a perforation the size of a silver three-cent piece was discovered on the anterior wall of the stomach, about half way between the greater and lesser curvatures and 3 or 4 inches from the pylorus. The perforation was closed by a chromic catgut suture and reinforced by two layers of Lembert sutures of linen thread. Gastro-enterostomy was not performed. The subphrenic abscess was thoroughly drained by two rubber tubes and three cigarette drains. A glass tube was placed in the pelvis through a button-hole incision. This

patient developed pneumonia, which was followed by an abscess of the left lung for which she was operated on by Dr. Francis T. Stewart, who stated that the abscess he opened was probably not the only one, as she continued to run some temperature

CASE IV—Male, age forty-two, admitted to the Germantown Hospital, February 28, 1914, about 2 A M, suffering intense pain in the upper abdomen. Patient states that while at work lifting a heavy bar he was taken with a sudden pain in the epigastrium, which he described as feeling like being stabbed with a knife. Patient managed to get to a drug store where he was given some treatment by the druggist. A few minutes after the first dose he felt a little better and was then given a second dose. Following this he had intense pain which was sharp and excruciating, like the first. Before he left, the druggist gave him a dose of magnesium sulphate. He was suffering such intense pain that he was unable to get home, but managed to reach a cousin's house in Germantown where a doctor was called in. The doctor immediately washed out his stomach, a great deal of fluid was poured into the stomach but little removed. As the patient grew very much worse he was sent to the Germantown Hospital where a diagnosis of perforated gastric ulcer was made by the surgical resident, Dr. Williams, and Dr. Ross was notified and came out immediately and operated. White blood-cells were 24,000.

The patient had never been troubled with indigestion, never had pain before or after eating, always healthy. No history of gastric disturbances. Examination revealed a poorly nourished adult male, with abdomen markedly distended and rigid.

On opening the peritoneum, large quantities of gas and stomach contents escaped, including all three doses of medicine administered by the druggist, to say nothing of the washings of the doctor. Owing to the kindly ministrations of the druggist and doctor it was some time before the perforation could be located. It was finally discovered on the anterior wall, about one and one-half inches from the pylorus. The opening was closed as described in the other cases and a posterior gastro-enterostomy performed, because of some induration extending from the perforation to the pylorus, suggesting the probability of pyloric obstruction, also because the closing of the ulcer diminished the size of the pyloric end of the stomach corresponding to the area of the ulcer. The upper wound was drained by a cigarette drain to the site of the closed perforation and a counter drain by glass tube was placed in the pelvis to allow the various medicines, etc., to escape from the pelvis. For 18 days this man steadily improved, was on modified house diet and seemed to be getting

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well. Then he developed peritonitis which seemed to start in the lower abdomen. He died on the twenty-second day after operation, of general septic peritonitis. Unfortunately no postmortem was permitted.

CASE V—Male, aged twenty-three, admitted to the German-town Hospital, March 26, 1914.

History—His trouble began on March 20, 1914, with feeling of malaise. On March 21, he got worse, had a chill and had to go to bed. He then felt better and got up. His nose bled yesterday (March 25, 1914). To-day he developed his abdominal soreness and pain in back of head and neck muscles. This evening he vomited. No nausea now. No appetite, very thirsty; bowels normal; occasional short dry cough, but this does not persist. He expectorates very thick tenacious mucus which is mixed with a sort of black blood. No pain in chest, no dyspnoea; feet never swell, no palpitation. Abdominal pain makes breathing very painful. Passes less urine than usual and it is dark colored and burns a good deal, no frequency.

Inspection of the abdomen revealed a few scattered minute pustules. One point suggestive of a rose spot was found. Tenderness over epigastrium. A little abdominal rigidity. No tenderness over McBurney's point. A mass is felt in upper left quadrant, extending about 6 cc below costal margin, presumably spleen. Abdomen tympanitic throughout. Audible peristalsis.

On the third day thereafter there was much more rigidity with a definite point of increased tenderness in the epigastrium. He now says that he has had pain occasionally for three years when hungry and this was relieved by eating. He had a sore throat the day before yesterday. Movable dullness elicited, suggesting fluid in abdomen. He cannot rest on his left side now, as it is too painful. Some blood, small amount, expectorated. Patient was transferred to surgical ward with a diagnosis of left side subphrenic abscess, probably due to perforating ulcer.

Operation on March 30, 1914, by Dr. Ross, assisted by Dr. Cope. A right rectus incision was made from costal margin extending downward along the border of rectus muscle—six inches long. On opening the abdomen quantities of pus escaped, which was carefully sponged away. On examination of stomach it was found distended, seemingly by gas, but none was seen to escape. Along the fundus was found a large, massive lymphatic exudate which extended upward over anterior surface, including gastrohepatic omentum and from gastrohepatic omentum upward, involving under surface of liver and posterior surface and lesser curvature of stomach. The finger was passed through

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gastrohepatic omentum and foramen of Winslow and a rough mass was detected on the posterior surface along the lesser curvature of stomach, which was taken to be a lymphatic exudate walling off the site of perforation. The different adhesions were broken up as well as it was possible to do so. On the left side of the suspensory ligament was found the abscess, which was directly underneath the diaphragm and between it and the liver. A cigarette drain was inserted directly to the right of the suspensory ligament to allow sufficient drainage of the subphrenic abscess. On the left two drains were inserted through the lesser omentum, one a cigarette drain and the other a rubber tubing, down to the site of perforation. The abdominal wall was then closed in the usual manner. As the abscess was definitely localized to the upper abdomen no drain was placed in the pelvis which proved to have been an error. The patient survived three days and then died of general suppurative peritonitis. The report of a partial postmortem follows.

The examination was of the abdomen and was performed through the incision made at operation for perforated gastric ulcer. The cadaver is one of an adult male, apparently thirty years of age, somewhat emaciated, with cheeks drawn and eyes sunken. Hair is normal, eyes, ears, and face show no special phenomena. The body frame is small and musculature is poor. Abdominal inspection. The abdomen presents an unhealed scar of the recent operation; and is flat, with little or no panicular adiposa and poor belly walls. Abdominal incision made by slightly enlarging the wound made at aforementioned operation. On inspection the whole abdomen presents the picture of a plastic suppurative exudate and older adhesions. This extends down into the pelvis and involves all the peritoneum. The pelvis contains about 20 c.c. of cloudy, flaky, serous fluid. The lesser curvature of the stomach is hemorrhagic, the gastrohepatic omentum shows a perforation about one inch in diameter, the entire upper abdomen is covered by a plastic exudate, while the jejunum and ileum are more free from this, but the great omentum is affected in the same degree with the upper abdomen. There is a bunch of small intestines firmly adherent in the pelvis. The appendix is normal. The cæcum and ascending colon are highly congested and firmly adherent to the wall. On section the stomach shows two small ulcers on the lesser curvature nearer the cardiac end, and one on the posterior surface which had perforated into the lesser peritoneal cavity. The duodenum is much degenerated and thin and presents one perforation about an inch in diameter on the posterior lateral aspect and still another about 2 inches in diameter on the anterior inferior surface. The lesser peritoneal cavity contained some fluid, while the peritoneum was markedly hemorrhagic. The wall of the duodenum is very thin in several places, having little more than the serous coat remaining. The liver and gall-bladder are normal. The kidneys are normal. The spleen is somewhat enlarged and shows hyper-

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trophy of the lymphoid tissue The intestines are congested throughout their entire length No enlargement of Peyer's patches were found

Summary of Findings—1 Plastic and suppurative peritonitis 2 Perforation into the lesser cavity 3 Perforation in the duodenum 4 Two ulcers on stomach mucosa nearer cardiac end

The sixth and last case is the one in which the diagnosis is still in doubt, although the reporter was of opinion that it was a case of perforation of the stomach at the greater curvature on the posterior surface, in which there was erosion of one of the vessels running along the greater curvature accounting for the massive hemorrhage

CASE VI—Male, fifty-two years of age, there was nothing in his family history that threw any light on his case He was a farmer and said he had been a little less strong than the average man of his class, not being able to lift so much He had also been troubled with chronic dyspepsia and for some time past, when he leaned over, he had tenderness in the epigastrium Two weeks ago, while at the dinner table, he had a pain in his epigastrium sufficiently severe to make him lie down This continued during the afternoon, and although it continued through the night he obtained some sleep The following morning at the breakfast table he had no desire to eat, and had an attack of excruciating pain so severe that it made him faint When coming out of his syncope he vomited dark brown granular material resembling coffee ground vomit. He then sent for his physician who said the man had no rigidity at all of the abdominal muscles He was tender in the right iliac fossa extending up toward the liver The doctor wanted him to go to the hospital that day, but he did not come till the following morning, travelling some 40 miles About 9.30 A.M. he was seen by Dr Ross His temperature was normal, pulse under 90, appearance rosy, lips pink, he had a leucocyte count of 11,000 There was absolutely no abdominal rigidity He was tender, starting to the left of the median line at the epigastrium, going over to the right side and down to Poupart's ligament, dull in right flank and a little less dull in the left flank. There was no distention, but his belly felt full and doughy and a little dull to percussion. It was evident that he had a serious intra-abdominal lesion of some sort Abdominal section was done at once On approaching the peritoneum the bluish appearance of hemorrhage was seen When the peritoneum was opened there gushed forth a tremendous amount of bright red blood, being more than in the ordinary case of extra-uterine pregnancy, followed by some thin, current jelly clot, while from the pelvis the clots were much darker and denser The appendix was in-

spected and found normal The small intestines were also normal as was the mesentery, the gall-bladder was normal. His gastro-colic omentum had an immense hæmatoma in it, between the layers of the transverse mesocolon there was another hæmatoma with a place in the left side which permitted the opening of his lesser peritoneal cavity in which was found some blood, and the posterior wall of the stomach, starting at the greater curvature, was infiltrated with hemorrhages

The man is making a good recovery A drain was introduced through the opening in the transverse mesocolon into the lesser peritoneal cavity and he is sitting up out of bed now, two weeks after operation, perfectly comfortable An examination of his pancreas, made rather hurriedly because of his general condition, showed nothing abnormal There was no evidence of effusion, no serum but comparatively fresh blood The liver, so far as could be seen, was all right, hemorrhage from a pancreatic vessel would not explain the hæmatoma in the posterior layer of the stomach, nor would it account for the immense hæmatoma in the gastrocolic omentum The veins around the stomach did appear very large but his conclusion was that the condition was due to a pin-point perforation at the greater curvature, going through the stomach wall and opening up one of the vessels on the greater curvature, the hemorrhage coming through the foramen of Winslow into the greater peritoneal cavity The liver was not materially changed in size from the normal There was an infinitely larger amount of blood in the greater peritoneal cavity than in the lesser

This series presents several facts worthy of notice Males, 4, females, 2, ages varied from 23 to 68 Time intervening between onset of symptoms and operation longest period 8 days, shortest, about 11 hours Of the two who died, perforation occurred about 6 days before operation Of those recovering one had perforated 8 days before operation and in one two days intervened, in the third about 20 hours and in the fourth over 24 hours Gastro-enterostomy was performed in two of the cases, one recovered (Dr Deaver's case); one died (Dr Ross' case) Site of perforation Duodenum, 1, stomach, 3 Multiple ulcer of the stomach and duodenum with perforation of stomach ulcer and two perforations of the duodenal ulcers The sixth case was gastric if the diagnosis of perforation is correct

DR MORRIS BOOTH MILLER reported the case of a man twenty-four years of age, who was admitted to the Polyclinic Hospital on January 22, 1913 He was taken suddenly ill with severe abdominal pain about

PERFORATED ULCERS OF STOMACH AND DUODENUM

five o'clock in the afternoon Previous history was that he had had attacks of pain over the region of his stomach for a number of months, but for about a month before this accident the pain had been more severe and had recurred more frequently He, however, had no vomiting at any time before the day he was stricken The painful attacks would occur about three hours after ingestion of food He was constipated When admitted to the hospital he presented that appearance which has been described aptly as one of abdominal tragedy,—sunken eye, pale face, anxious expression, with board-like, rather scaphoid belly, and tenderness marked in epigastrium and along the right flank The operation in this case was performed about four hours after the perforation As soon as the belly was opened the appearance of stomach contents and of gas was characteristic The perforation was about the size of the end of a lead pencil and was situated about two inches beyond the pyloric vein and well over on the upper surface of the duodenum On account of its depth it was difficult to catch and close, but he finally was able to close it with a double layer of sutures followed by a posterior gastro-enterostomy without a loop The necessity of that procedure had come home to him through a lesson which he learned in a previous case, in which he was obliged to reopen to do a posterior gastro-enterostomy to cure a man whose pain and other symptoms persisted after a simple closure of the perforation

DR JOHN H. JOPSON mentioned a case of perforation which developed a chronic lung abscess Dr Ross spoke of an acute lung abscess with drainage and recovery In one case in which perforation had occurred some two weeks before he saw the patient and in which the attending physician had made a diagnosis of perforation, the perforation had eventually been walled off At operation he found this condition—a subphrenic collection of cloudy fluid in the epigastrium, extending over the upper and under surface of the liver, which was covered with a thick fibrinous exudate The perforation had been sealed over, it seemed to have been in the first portion of the duodenum The area was drained, and in a short time the exudate broke down and the wound discharged thick pus This diminished and the man was discharged with a sinus A year later he died of brain abscess At autopsy an old abscess was found at the base of the man's lung adherent to the diaphragm The pathologist's idea was that this abscess at the base of the lung was chronic, had antedated the perforation and was associated with pulmonary tuberculosis from which the patient suffered Dr Jopson was convinced that this infection had spread from below

upward and resulted in a chronic abscess of the lung and that the brain abscess was secondary to that, and this in turn secondary to the perforation of the duodenal ulcer

DR GEORGE P MULLER reported the following cases of perforation of the stomach and duodenum

CASE I—Occurred in a woman, twenty-six years of age, who presented a history of symptoms suggestive of gastric ulcer. She was given a thorough treatment by an osteopath and shortly after complained of acute symptoms over the gall-bladder, tenderness, rigidity, and finally the appearance of a mass. There was fever and increased pulse rate. At operation at the Chester County Hospital, October 23, 1909, a large, perforated ulcer was found. It was carefully sutured and the site drained. Symptoms of pyloric stenosis gradually appeared and finally became so intense as to demand operation a year later, at which time a posterior gastrojejunostomy was done. The patient immediately began to gain weight and now is in perfect health.

CASE II—Man, aged forty, who gave a typical history of duodenal ulcer for six or eight months previous to perforation. The symptoms of the latter resembled appendicitis and he had marked tenderness over the appendix upon admission to the hospital. Temperature, 101.8° , pulse, 88, respiration, 32, leucocytes, 17,700. The operation (University Hospital, December 18, 1909) was performed thirteen hours after perforation. The appendix was first exposed and found congested, but as turbid fluid was seen running down from above a second incision was made and the perforation discovered, two inches from the pylorus. The perforation was rather large and was closed with a purse-string catgut suture, reinforced with a catgut mattress suture, drainage was introduced to the site of suture, to the kidney pouch, and through a stab wound to the pelvis. Ten days later a duodenal fistula appeared and discharged bile and pancreatic juice, greatly excoriating the skin. Accordingly, a posterior gastrojejunostomy was done through a second incision and in a week the fistula had closed. Patient was discharged 31 days after operation with the wounds practically healed.

CASE III—Man, aged fifty-five, without any previous history whatever of dyspepsia. He was suddenly seized with pain in the epigastrium and marked rigidity. There was tenderness over the gall-bladder region and the pain was referred through to the back. On admission to the hospital temperature was 98.6° , pulse, 90, respiration, 28. Perforated duodenal ulcer was diagnosed and operation performed three hours from the time of perforation.

PERFORATED ULCERS OF STOMACH AND DUODENUM

at the University Hospital, July 12, 1910. A small perforation was found and closed with silk and the site of perforation drained. Patient was discharged five weeks after operation with wound entirely healed.

CASE IV.—Admitted to the St. Agnes Hospital during 1912. She was a woman, thirty-five years of age, who for some time had had dyspepsia and was then seized with pain followed by symptoms of peritonitis, although they were not recognized by the attending physician. She was sent in as a case of intestinal obstruction, about one week after the onset of symptoms, and the abdomen opened under local anæsthesia under that impression. A large perforation in the anterior wall of the stomach was found and also a general suppurative peritonitis. A rubber tube was sewed in to the perforation and nothing else done. Patient died in three hours.

CASE V.—Man of sixty-eight years who had suffered for some years from attacks of pain after eating and accompanied by belching. On April 20, 1912, he was suddenly seized with severe pain over the liver, radiating to the right shoulder, followed by vomiting and then by some distention of the abdomen. Temperature rose to 101° and remained about that figure. Vomiting continued and the distention increased, patient was never shocked and seemed bright and cheerful. Three days after the onset of symptoms he was seen by Dr. Muller, he was complaining of abdominal pain, mostly in the right iliac fossa, with persistent nausea and vomiting of black material. The abdomen was tightly distended. At operation (Presbyterian Hospital, April 23, 1912) there was found a very small perforation in the anterior wall of the duodenum. This was closed with linen and catgut reinforced by a tag of omentum. In addition he had a general purulent peritonitis, especially in the upper portions. The site of anastomosis was drained and the pelvis was drained, but the patient died twelve days after operation with symptoms of increasing toxæmia and perhaps of subphrenic abscess. We were not allowed to operate a second time and were not allowed to perform an autopsy.

CASE VI.—Man, thirty-eight years of age, who gave a vague history of previous indigestion. While at work he was suddenly seized with pain in the epigastrium, followed by vomiting, and on admission was extremely rigid in the epigastrium and had tenderness over the gall-bladder. Temperature was 99° ; pulse, 100, respiration, 20, leucocytes, 20,700. The lesion was correctly diagnosed and the patient operated upon one and one-half hours from the time of perforation. At operation (Polyclinic Hospital, September 24, 1913) a small perforation of the anterior wall of

the duodenum close to the pylorus was found. The perforation was closed and a posterior gastro-enterostomy performed and the site of perforation drained. A second drain was introduced to the pelvis. He was discharged in a few weeks with wounds entirely healed.

It will thus be seen that of the four cases which recovered, three were operated upon at a very early period and in the fourth, localization occurred, saving the patient. The reporter believes that a primary gastrojejunostomy should be performed if feasible, that is, if the operator is skilful enough to avoid extensive soiling of the peritoneal surfaces and if time is not an important element affecting the prognosis. It is interesting to note the almost immediate cure of a duodenal fistula by gastrojejunostomy.

In addition to these six acute perforations he had had two examples of what might be called chronic perforation.

The first occurred in a woman of twenty-two, with a typical history of ulcer, who was treated medically for some time with relief, but with recurrence. At operation (University Hospital, October 8, 1913) a duodenal ulcer was found which by reason of scarring and infiltration had produced some stenosis. In addition an ulcer of the posterior wall just below the lesser curvature had perforated the entire stomach wall, the infiltrated transverse mesocolon forming the base of the ulcer. The latter had almost perforated and, accordingly, the mass of infiltrated mesocolon together with the ulcer was excised. The wound in the stomach was closed and just posterior to it a no-loop gastrojejunostomy was performed in the usual manner. This patient seems to have made a perfect recovery. She had hemorrhage from the stomach two weeks after operation but recovered therefrom and is now doing well.

The second case was most interesting. It was in a man fifty years of age, who following an attack of dysentery began to suffer from pain in the upper abdomen which, during three years, gradually developed into a typical case of duodenal ulcer. At operation (University Hospital, November 19, 1910), a mass of adhesions was found in the region of the pylorus but no evidence of ulcer, although the pyloric end of the stomach felt thick and beefy and the duodenum was dilated. The adhesions were separated and the wound closed. Through a second incision a thickened constricted appendix was removed, the omentum being adherent. The patient improved and recovered from operation and for some time did well, but gradually the symptoms recurred,



FIG 11—Congenital perforations of the parietal bones (external aspect)



FIG 12—Congenital perforations of the parietal bones (internal aspect) Thinness of bone shown by light area behind left foramen

CONGENITAL PERFORATIONS OF PARIETAL BONES

although there was some difference, as the pain was noticed more immediately after eating. After several years of medical treatment, a radiogram by Dr. Pfahler diagnosed a perforated gastric ulcer together with evidence of adhesions, etc. At operation at the Chester County Hospital, May 2, 1914, a perforated ulcer of the posterior wall was found surrounded by a small mass of exudate which in turn was adherent to the pancreas. The ulcer and a portion of the stomach was excised and the wound closed. Because the operation took time and owing to the difficulty in separating the adhesions and the presence of much oozing, it was deemed inadvisable to perform gastrojejunostomy at that time.

CONGENITAL PERFORATIONS OF THE PARIETAL BONES

DR PENN G. SKILLERN, JR presented a calvarium, discovered in the dissecting room of the University of Pennsylvania, which presented a very rare condition, and one that would give rise to confusion clinically were its occurrence not borne in mind, namely, congenital perforations of the parietal bones. In a review of the subject in 1902, Piersol (*Univ of Penna Med Bull*, August-September, 1902) described and illustrated a case, and was able to collect but fourteen other specimens.

In this case (Fig 11) the perforations are irregularly round, and very symmetrical as to size and position. Both occupy the centre of a depressed area, which readily transmits light (Fig 12). The edge of each perforation is as thin as paper, and the surrounding bone increases in thickness until the periphery of the depressed area is reached.¹ On the right side the perforation measures 14 mm transversely and 12 mm anteroposteriorly, and readily admits the tip of the little finger. It is situated 3.5 cm from the sagittal suture. On the left side the perforation measures 15 mm transversely and 13 mm anteroposteriorly, and admits the tip of the index. It is situated 2.5 cm from the sagittal suture. Each perforation was filled in by the epicranium externally and the dura internally, both of which were inseparably blended.

These parietal perforations are probably due to an exaggeration of the local disturbance of ossification which ordinarily results in the formation of the normal foramina, induced by unusual intracranial pressure within the immature skull. Welcker and Toldt (*Spec Speclelehre, Bardeleben's Hands. D Anat D Menschen* 1896 Band 1.

¹ Prof Geo A Piersol, who examined this specimen, suggested that this progressive thinning represented an attempt at complete filling of the defect by ossification.

S. 114, cited by Piersol) state that the normal development of the parietal foramina is closely associated with a cleft, usually about 5 mm deep, on the mesial border of the young parietal bone. Within this cleft lies a perforating blood-vessel, commonly the emissary vein, which obstructs ossification at that point and causes the separation of the rays of developing bone. The subsequent closure of the fissure proceeds from the sagittal suture outward, the lateral or outer end of the cleft persisting as the parietal foramen. Piersol states that the generally recognized close relation between parietal perforations and parietal foramina admits of little question, especially when we consider the similarity of position, the symmetrical form and disposition of the apertures, as well as the observed gradual transitions from the large foramen to the huge hole.

Clinically, such perforations, were their occurrence not borne in mind, would cause confusion in palpation of the skull, in which the pulsations of the brain may be felt, in the examination of lacerated wounds of the scalp for underlying fracture of the skull, in the exposure of this area of the skull at operations, and in the examination of skiagrams of the skull.

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